GEOLOGY, RESOURCES & INDUSTRIES

EDISON ELECTRIC INSTITUTE BULLETIN

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EDISON ELECTRIC INSTITUTE

THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

July, 1940

CLASSIFICATION OF SALES (Revised Series)

	1940	1939	%
Number of Customers as of JULY 31st			
Residential or Domestic	24,525,325	23,603,461	+ 3.9
Rural (Distinct Rural Rates)	672,289	608,698	+10.4
Commercial or Industrial:			
Small Light and Power	4,237,728	4,183,594	+ 1.3
Large Light and Power	180,277	185,622	− 3.0
Street and Highway Lighting	24,024	24,956	.....
Other Public Authorities	85,212	75,729	.....
Railways and Railroads:			
Street and Interurban Railways	207	218	.....
Electrified Steam Railroads	27	30	.....
Interdepartmental	1,251	1,125	.....
Total Ultimate Customers	**29,726,340**	**28,683,433**	**+ 3.6**
Kilowatthour Sales During Month of JULY			
Residential or Domestic	1,769,052,000	1,617,636,000	+ 9.4
Rural (Distinct Rural Rates)	260,502,000	247,172,000	+ 5.4
Commercial or Industrial:			
Small Light and Power	1,819,501,000	1,718,977,000	+ 5.8
Large Light and Power	4,908,323,000	4,101,896,000	+19.7
Street and Highway Lighting	135,954,000	133,189,000	+ 2.1
Other Public Authorities	212,281,000	213,105,000	− 0.4
Railways and Railroads:			
Street and Interurban Railways	293,513,000	292,340,000	+ 0.4
Electrified Steam Railroads	150,373,000	142,927,000	+ 5.2
Interdepartmental	60,716,000	52,613,000	+15.4
Total to Ultimate Customers	**9,610,215,000**	**8,519,855,000**	**+12.7**
Revenue from Ultimate Customers	**$195,555,900**	**$184,318,700**	**+ 6.1**

RESIDENTIAL OR DOMESTIC SERVICE (Revised Series)

Average Customer Data for the 12 Months Ended JULY 31st			
Kilowatthours per Customer	931	879	+ 5.9
Average Annual Bill	$36.31	$35.69	+ 1.7
Revenue per Kilowatthour	3.90¢	4.06¢	− 3.9

GENERATION FOR THE U. S. POWER SUPPLY AS A WHOLE FOR THE MONTH OF JULY (000's kwhrs)

	1940	1939	%	1938	1937
Fuel	7,682,954	6 975,255	+ 10.1	5,694,331	6,783,862
Hydro	4,071,124	3,395,650	+ 19.9	3,622,831	3,340,268
Total	**11,754,078**	**10,370,905**	**+ 13.3**	**9,317,162**	**10,124,130**

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 8 OCTOBER, 1940 No. 10

Conserving Our Greatest Asset—Man Power

By W. E. Mitchell

Vice-President and General Manager, Georgia Power Company

Address before the 29th National Safety Congress of the National Safety Council, Chicago, Ill. October 7-11, 1940

WE are entering into a great program of National Defense. It means a tremendous industrial expansion, a conversion to new fields and a building of the mechanical instruments of destruction or defense undreamed of by us one year ago.

If the program is to be successful, it means organization and training for mass production in new fields. It means the taking of hundreds of thousands of men out of their present work and their replacement by new, untrained people. The brilliance and efficiency of Germany's technical preparation for their attempt at world domination is a challenge to us who have always prided ourselves on our superiority in mass production.

But isn't it also a challenge to us in another way? Doesn't it drive home as never before the necessity of an organization in every industry and in every company for the intensification and revitalization of our safety programs, to the end that the defense job (and every one of us are involved in it) is done not only efficiently and rapidly, but also SAFELY?

The great numbers of new employees must be started off right, must be trained to work safely as well as rapidly. Because we are preparing to defend ourselves from possible destruction doesn't lessen the need to avoid injury and death during the preparation. It seems to me the present situation presents a great opportunity to improve our safety records, not simply because we like records, but because they will denote individuals saved from death or partial disability for useful work and to the enjoyment of their families. In other words, conservation of our man power.

American industry is safety-minded. It has grown much more so during the past twenty-five years, as any of us who have been a part of it during that period can testify, and as the records amply prove. We Americans may be exceedingly careless of human life and limb when we get behind the steering wheel on our broad highways, but not so in our factories.

How can this great job of preparedness and safety be done? It will require—

A definite, complete, adequate and integrated plan.

Thorough preparation.

Full utilization of industrial knowledge and skill.

Extensive use of research and invention.

Thorough training and discipline.

Hard work and devotion to duty.

Any Safety Program, if it is to last and be worthwhile, must start from the top. It must be genuine—no flash in the pan—and must proceed from an honest and sincere interest in the workman's welfare. That from a purely selfish viewpoint, it is also good business, should only make it more desirable.

It must not become mechanical, a lot of forms, reports, etc. Accident prevention must be kept personalized, humanized and dramatized. *We ought to dramatize* safety more! While a sound program must make a permanent, lasting appeal to the intelligence—an appeal to the emotions may often be the starting point. Let's be as smart as Hitler in appealing to the emotions. Interest must be maintained. New methods, where they are improvements over old ones, should be publicized. There must be high morale or *esprit de corps*. To say foremen are key men is trite, but true. If they are sold head and heart on safety, the job is two-thirds done.

Most of us have talked a lot about safety. All of us have given it lip service, and *some* have done a really constructive job, but many of us are like that farming community in Northeast Georgia that I heard about. They were experiencing a drought and they called on Farmer Jones, a very successful farmer in an adjoining county, who was also somewhat of a preacher, to come over and pray for rain. He consented; they had a big gathering, and his prayer went something like this:

"Oh, Lord, these people have asked me to pray for rain and so I'm praying, Lord, but, Lord, You know, and I know, and they ought to know that what they need isn't rain, but deeper plowing, more fertilizer, and better cultivation."

I think this applies to many safety programs. Lots of wishful theoretical thinking, not enough sound, practical human understanding.

Some 37 years ago as a young college graduate serving an 18 months' apprenticeship, I saw six or eight men who lost their lives through electric shock. Nearly every one of them was a preventable accident. Every one of these men was above the average in intelligence, all were college trained men. One night I carelessly stuck my finger too close to an ammeter in a high voltage circuit. I only got the static but it set me back on my heels and rattled my teeth. It was a salutary warning that white tape was strung around the test to keep us out of danger, and that there seldom was a second chance if you got careless with the "juice."

Going from there to Brazil on hydroelectric power plant construction, almost

the first Portuguese word I learned was "Quidado"—*Be Careful!* For a time it seemed to be only a slogan, for we had so many serious or fatal accidents that the superstitious workmen would come and beg us not to start any new work on Friday. It seemed that every job started on a Friday brought bad luck. But the trouble wasn't with Friday nor with "Quidado"; it was much more fundamental. We hadn't learned to actually be careful. It was tough schooling for a young engineer, but unquestionably it drove home certain lessons that can never be forgotten.

The passing years have only served to make me have a greater respect for the hazards the electrician and lineman face daily, a greater appreciation of the importance of sound safety work and an understanding of the importance, and ultimate economy of sound operating practices and training in accident prevention in a necessarily hazardous business and the value of these as real conservers of man power in the truest sense.

If the time to make friends is before you need them, if the time to prepare for war is in time of peace; then certainly the time to prevent accidents is before they happen! This means the ground work of any sound safety program must be well thought out, painstakingly checked for its weaknesses, thoroughly organized, and last, but far from least, constantly and consistently followed up.

The warring nations have taught us how effective propaganda can be and how far it can penetrate. If so effective for subversive purposes, why not equally so for desirable aims, such as safety? Let's make better use of it!

It is particularly difficult today when our hearts and minds are so full of what is happening in Europe, where England, hardly bigger than the State of Illinois, stands alone with her fleet and that handful of magnificent youngsters of the Royal Air Force, the last barrier between the totalitarian tyrant and our own rich, unprepared country. Belatedly, we are now awakening to the danger of our present position, to the need of extraordinary measures for National Defense, for National Unity and a willingness to sweat and sacrifice such as our founding fathers displayed 165 years ago.

The time is desperately short; it's not credit, it's not money now, but gruelling hard work by every one of us that is needed. We may be soft and unprepared, but we are not rotten at the core; we are sound at heart, we have the facilities and can train off our surplus fat, harden our muscles and do this great job of preparing our National Defense in a way that will surprise the world. Courage and broomsticks won't stop tanks or dive bombers. In the present mad world our only hope is to be so strong none dare attack us.

As Roger Babson says:—"Planes and guns are not enough for National Defense. Physical fitness of recruits is not enough. To succeed, the entire country must experience a spiritual rebirth. Only righteousness will save a nation."

How those quiet words of King George—"We have just begun to fight. All of us must trust, as I do, in the help of God to bring victory to our cause" stir our hearts! The trouble with democracies is that their emotions are quick but their minds are dilatory. Therefore, we face the great job of training hundreds of thousands of men, not simply as soldiers, sailors and pilots, but as mechanics, electricians—skilled workmen of all types, and they must be taught how to protect themselves at the same time.

So after all, perhaps it is fitting here to turn our thoughts to saving life; to training men; to building morale. In our speeded up program we'll need every skilled workman, we'll need as never before even more loyal organizations, more willingness to sacrifice. We must prepare training programs to insure that the new men are ready to take over the jobs made vacant by the shifts due to the National Defense Program, which is now, thank God, gathering momentum!

How better can we conserve our man power than through a sound safety program? Surely we'll want loyalty and employee morale. But morale, or esprit de corps, isn't something you get by direct action. It must come as a result of certain conditions and attitudes of the management which denote the genuine and continued interest of management in the personal well-being of every employee, and which thereby merits the employee's loyalty. I maintain it should be the natural result of a sound safety program.

Safety isn't simply a slogan, something to make cartoons about and to fill files with records. It is much more than that! The steady reduction in industrial accidents, fatal and otherwise; the development of safer operating practices, didn't just happen. I know there are still some slogan writing, swivel chair safety directors at their mahogany desks studying at great length their never ending reports and records—fine, theoretical chaps who think they know a lot about psychology and social values, but who never wore a pair of overalls and to whom the language and mental processes of the normal, two-fisted mechanic, steel worker or lineman are the purest Greek.

Don't misunderstand me, I believe in records; they are necessary details, and there is a place for psychology, but the main issue is making industry safer for those who make up its back-bone—our American working-man. It often means doing so when those whom we are most anxious to protect think it is just a fad of the boss. That it is no fad is readily seen if you run through the files of the National Safety Council conferences, and note the men who have been most outspoken as to management's responsibility. You will get further proof of the great interest in safety by scanning the advertisements in the National Safety News and seeing the many and diverse articles available for the protection of the worker and for the promotion of safer working conditions.

These things I submit are essential to any sound safety program. *It is management's first and primary responsibility in accident prevention to make the conditions of the work place physically safe.* Only when this is done, can management successfully ask the workers to take their active part—and a very necessary part it is—in any safety program. When management does its full part, however, it is easy to get the employees to understand the importance of safety, and educational measures will be readily accepted and followed.

The wages paid must be fair and adequate and there must be reasonable permanency in the job if we expect the workman to become interested in accident prevention.

It is the duty and obligation of a company to take the leadership in activities of this kind from which the employees benefit. *The president or general manager cannot delegate the organization of the safety program to some minor subordinate.* This is not the way management gets results in production, or in purchasing, or in selling. Management must realize that the functioning of the safety program is just as important to efficiency in the plant as any other major activity. *Accidents are pure waste of men, materials and money!* The

primary objectives of the safety program are to eliminate these needless wastes, and, therefore, safety is an important part of management's business.

The management must take the leading part in a program of accident prevention that amounts to anything. The management *has to initiate it, see that it permeates the whole organization, give it emotional appeal, and keep it alive and going after the first interest has died down.* You can employ safety directors to advise with the management, and with the men about good techniques; safety directors can help to carry out the policies of the management, *but they can't do the job all alone, without the assistance of management.* You can't hire a safety director and say, "Now, George, you do this job and don't bother me any more." Safety can't be bought, any more than you could go out and buy character for your business.

The foreman is the key man in any safety program, but he'll never truly enter into it, nor sell his men on it, unless the superintendents and supervisory staff, clear up to the general manager and president, are also thoroughly sold on the worthwhileness of it. So I say a sane safety program must be organized from the top down.

Has it ever been your job to work for several hours in a vain effort to resuscitate a fine, young lineman, knowing in your heart it was an unnecessary accident, and then have to go and break the news to a poor, frightened, crushed young woman, whose only means of support that man was? Unfortunately, that has been my painful duty a number of times. If nothing else had done so, this would have made me a firm believer in safe practices.

Management must, of course, have strong hands upon which it can depend for carrying out the accident prevention details. But management cannot depend merely upon receiving reports. Management must meet with the committees, must participate in some of the investigations, must know personally the procedure of training and must actually lead all employees in the campaign against accidents.

Employees are sensitive to every attitude in the president's office. If safety is thought of great importance there, this attitude will certainly be reflected down through the supervisors and foremen to every employee. If safety is merely a side issue, a half-hearted experiment in the president's office, without question the supervisors and all employees will have exactly this same attitude toward safety work in their work practices.

Accident prevention is good business. Safe methods of work save money for the company. *It is good enough business for the management to give it full and serious attention.* You all know that accidents cost money. In my own company we have a very active safety program. It has been carried on for years. We devote much thought and study to it. Our record has steadily improved, though we have occasional lapses. Nevertheless, in spite of the fact that our employees are thoroughly trained in both the technique and spirit of safe work, we do have accidents. The direct measurable expense of these accidents to the company amounts to $40,000 to $50,000 per year. That includes only out-of-pocket expenditures for medical treatment, hospital bills, workmen's compensation and funeral expenses. But that is only a small part of the total cost.

When an accident occurs, work is disrupted, possibly equipment is damaged; if a new man has to fill a vacancy caused by an injury, there is a slowing up and loss of efficiency for a time until the new man learns his job. There is always the possibility that the new man will make a serious mistake on unfamiliar work. When the injured man returns to the job, after recovering from his accident, he is still far from his peak of efficiency as a worker and does not reach that peak again for a long time. These are what we might call indirect expenses, but they are just as real as direct expenses.

Looking at it cold-bloodedly, simply from a profit and loss standpoint, management owes just as great an obligation to the stockholders to initiate, direct and stimulate safety work as to direct the production processes. You wouldn't turn over your production machinery to your foreman and laborers and say, "Here now, boys, you know how to operate these machines. Just go ahead and turn out our product and don't bother me with the details." You wouldn't hire a group of salesmen and tell them to go out and sell what they could and come back at the end of the year and tell you what they had done. To imagine running a business that way is simply absurd. It is just as absurd to think of running a safety program that way. *Safety is just as much a part of the responsibility of good management as good operating practices or good sales methods—and I may say it pays just as good dividends.* We go to great lengths to conserve our companies' physical assets; why not more attention to conserving its greatest asset—its employees?

Here is another aspect of safety—perhaps as important as the dollars and cents cost of accidents. *The safe way of doing a job is, in the long run, the best way of doing it.* The safe way is the most efficient way, the least expensive way, and the easiest way for the men. A man who does his job safely will do a better job. If he is in a manufacturing plant he will turn out a better piece of work. He will put into his work the ingredient of safety. Thus the safe workman is also a better workman. He has a sense of responsibility. It makes him a better citizen. A safe worker is likely to be a careful automobile driver; he is likely to be a safety man in his own home. He helps to reduce the frightful toll of traffic accidents and home accidents insofar as his own conduct and his own influence extend.

Safety work extends far beyond just showing a man how to do a job properly and providing him with the right tools and safety devices. A foreman cannot be expected to take the responsibility and carry it out unaided. *Nor will superintendents and supervisors and safety directors continue the work, once started, without constant stimulation from the management.* Safety training, in the larger sense of the word, extends into the workman's private life. A man who is beset by worries over poor health, personal debts, or other domestic or private difficulties, cannot do his best work. He cannot concentrate fully on his job, but is distracted by his personal problems. This distraction and lack of concentration make him a dangerous workman. Sooner or later he will have an accident through inattention.

To get to the cause of accidents, management must assume a social responsibility for the welfare of its employees. The executive heads of large businesses are frequently called upon to take the leadership in various charitable and public welfare movements. By reason of their executive ability they are able to assume these responsibilities, and indeed they ought to do so for the good of the community. Nevertheless, (and I think many executives are inclined to overlook this point) their first duty is to their own employees.

The workman naturally grows careless. Familiarity may not breed con-

tempt, but it does dull the sense of danger. Mere talk won't rouse him. It's the foreman's job to watch out for him. Also the helper's. But his best protection is thorough training in the fundamentals of safe methods of work. Then habit and instinctive reflex action may save him in a tight spot. "Psychology," Henry C. Link says, "is simply a scientific *study of habits and their formation;* first so those habits may be better understood, and second, *so they may be better controlled.*" He proves it very simply and conclusively with the question: "Did you ever hear of a child being born with the multiplication table or the ABC's already in his mind? These are habits, and no matter how good a child's heredity, no matter how high his capacity at birth, these habits, like most habits, can be acquired only *through practice, repetition, imitation and discipline.*"

Are not a lot of our failures and disappointments in connection with safety due to our failure to appreciate, to continue to everlastingly *practice,* and *imitate* the best, and *to discipline until definite habits are formed?*

Perhaps the most important thing about a safety program is that it is habit-forming. It forms habits of the right kind, and therefore, *it builds character and makes better men.* A man who has become conscious of "tripping hazards" by reason of his company training, doesn't leave a pile of rubbish or an empty bucket on the dark basement stairs in his home. Automatically, he puts the bucket or trash where it should be. It has become a habit. He does it without thinking about it. It has become almost reflex action for him to follow correct safety practices in all the circumstances of his life.

Now you say, fine, but does safety really work? What proof have you that it will conserve man power; that it will reduce labor turnover; that it will improve efficiency? Fair enough. I can only answer from my own company's experience, where we have had an active safety organization for the past 14 years, but from Georgia Power Company's experience, I can answer emphatically in the affirmative to all these questions.

We have handled our safety work with a setup of a safety council and a secretary or director of safety, similar to those usually in vogue. Because of the hazards involved in electrical work, *special attention has been devoted to definite, practical training in first aid and the prone pressure method of artificial resuscitation by every line and sub-station crew and by all inspectors, metermen and appliance service men. Approximately 2,500 men in these groups have had this training.*

In the past ten years a great reduction had been made in fatal and serious accidents, but we were still having too many. So two years ago we reorganized our general safety committee, with the general manager as chairman, and the division managers and department-heads as members. Under this group *we organized two main sub-committees*—the Electric Operating Department Safety Committee and the Transportation Department Safety Committee. *We placed renewed emphasis on the proper training of the men, on the foreman's responsibility, and we continued our training in artificial resuscitation. 1563 employees have completed the standard 20-hour Red Cross First Aid course during the past three years.* They did this voluntarily and on their own time. And 200 non-employees took the course along with our employees.

We were not satisfied, for we had, it seemed, an epidemic of serious accidents —five fatal ones—in the summer and fall of 1938. The men were discouraged, for in the last eight cases they failed to revive the men who had touched the "hot stuff." Then, through my old friend, Mr. E. C. Stone, vice-president of the Duquesne Light Company of Pittsburgh, we learned of their success with what is termed "Pole-Top" resuscitation. We decided to try it.

Mr. Stone kindly loaned us his safety engineer, Mr. W. T. Hawkins, and two of his regular linemen, Messrs. Ed. Rebel and Frank Hartman, for a week. In August of last year we held a training school in Atlanta under the direction of these three men and brought in from ten to fifteen linemen and foremen from each of our five outside divisions, and all of our foremen and linemen (about 200) from the Atlanta Division. These men didn't simply look on—they worked on each other. Also, we invited, about 50 safety engineers, linemen and foremen from other electric companies in the Southeast from Maryland to Louisiana, attended. *Along with this training, we stressed more than ever before that the use of rubber blankets, pigs, etc., to cover up all wires, was the one sure way to prevent accidents.* I cannot speak too highly of the excellent instruction Mr. Stone's men gave us. The result—a new interest in safety, more careful work, and a belief on the part of the men that there was something to this safety stuff.

But let me give you the sequel. It happened last November 9th, and how well I remember it. I was at dinner with Mrs. Mitchell and our daughter when the 'phone rang. It was A. C. Henderson, Assistant Division Superintendent at Columbus, calling: "Mr. Mitchell, we have had a bad accident." Their instructions are to call me at the earliest moment on serious accidents. My heart sank and I thought: "Another fatality." Then from Henderson: "Lineman West was checking voltage on an 11,000 volt circuit and in some way contacted a live wire. He was dead as a mackerel, Mr. Mitchell, but his buddy, Lineman Poyner, who was opposite him on the pole, had had the training in pole-top resuscitation and he didn't lose a minute, but went right to work and West is alive! Poyner brought him to in about five minutes. He has a severe burn, but he's all right." I went back to the table. Mrs. Mitchell asked what happened and my daughter said it sounded as though someone were killed but wasn't. "Right," I said, "a man was dead but he's alive again. It's the best news I've had about an accident in many a day." Nothing has so vitalized our safety work in the past five years.

Every serious accident that occurs on our system is promptly investigated by a committee, the majority of whom have no direct responsibility for the work where the accident happened. In this manner a more impartial, thorough and prompt report of the actual causes of the accident is made. It is also this committee's duty to make specific recommendations and thus prevent a recurrence. This report is mimeographed and sent to every division, where it is made the subject of discussion, and believe me, these discussions are free and frank. Many a foreman who thought he had no responsibility and that the accident couldn't have been avoided, changed his mind before the "courtmartial" was finished. An impartial, thorough investigating committee can usually find the true cause of every serious accident. The important thing is to prevent a recurrence by a thorough explanation and discussion of the accident with all other crews liable to be caught in similar circumstances. Firm, prompt penalties for carelessness or infraction of safety rules are applied. In our business the fore-

man's first duty is the safety of his men and it is our endeavor to never let him forget that fact.

In the regular quarterly divisional operating practice meetings, where all phases of the company's operations, such as rural line specifications and construction, cost of fuse replacements, servicing customers' appliances, unnecessary automobile expense, high line and substation maintenance methods, etc., are discussed, safety and safe methods of doing difficult and hazardous jobs are discussed by foremen as much as by engineers, and their effect upon costs brought out.

Last fall we persuaded one of our ablest construction line foremen to take a job as safety engineer under our safety director. He accepted the job only when we showed him what an opportunity it offered not only to train men in safe operating practices, but also to do better work and to do it more economically. He travels from crew to crew all over the state, spending from one to three days with each, observing how they handle their jobs and offering sane, practical suggestions from his wide experience; checks up on their tools and protective equipment, and makes safety something very real and very practical to a very live, smart crew of hikers. This fall this man was promoted to a still more important job and his successor as safety engineer is another up and coming, able, young line foreman who two years ago was a journeyman lineman on his hooks. He knows his line work, its hazards and the value of safety. *Yes, safety training prevents accidents and conserves man power.*

Our distribution costs per customer are as low today as ten years ago, although hours have decreased from 50 to 40 per week and wages have increased over 25 per cent. *Yes, sound safety training and organization improve efficiency.*

Some 562 automobiles and 175 trucks have traveled 31,500,000 miles in all kinds of weather over all kinds of roads in all parts of Georgia since the last fatal accident, whereas the average for the State of Georgia for all vehicles is only 5,900,000 miles per fatality. Our record is nearly five and one-half times as good as the average. *This means real saving.*

Our appliance repair department, employing approximately 70 men, have worked 1,480,000 man hours since Feb. 14, 1929, the date of their last lost time accident. *Certainly we think safety training pays!*

A really complete and socially useful safety program involves, in addition to accident prevention training, such additional benefits as *health and accident insurance,* provision for hospitalization in case of illness, annual medical examinations for all employees over a certain age, credit unions through which employees can borrow money at reasonable rates of interest, and so on.

One of the best things management can do is to become acquainted with the personal problems of the individual employees and to take the trouble to advise with them about their difficulties. The executive should be a friend and confidant, as well as an employer. His office door should always be open to any employee. Paternalistic, some will say. Perhaps so, but if done with a genuine interest in the employee's wellbeing, it will work wonders.

Of course every person entering our employment must pass a medical examination. That's the very beginning of the safety program. *Greater and greater care is being taken in the selection of each new employee, not simply to be sure he is sound in mind and limb, but that mentally he is fitted for the job.* We hope we are hiring him for life; we are going to invest a lot of time and money in training him, and will incur definite obligations to him, which obligations grow greater with each additional year of service.

But we don't stop with the initial or entrance examination. Some years ago we started examining annually our trainmen who were over 40 years of age. We were astounded to find the number who had serious physical disabilities. We now apply this annual examination to all employees over 40, (approximately 2000 people) office and field alike, free of charge, by physicians selected by the company. This has lengthened the useful life of many employees and probably has prevented some serious accidents. *The value of these examinations is reflected in a decrease in the death rate and improvement in the general health of employees as indicated by the decrease in insurance claims during the past several years.* Again I hear someone say this is too paternalistic. *We call it plain good business sense.*

Does the stipend in the semi-monthly pay envelope discharge the company's full obligation? I don't think so. In times of stress, whether from outside political attack, or labor disturbances, or operating emergencies, we want employee loyalty and usually get it, but let us not wait until these emergencies arise before we begin doing those things that create loyalty. Sometimes it does take a bad accident to wake us up, but generally we believe in the ounce of prevention.

This past year we added hospitalization to the former Accident and Health Group Insurance available to employees. A great many employees have had needed operations performed that they had previously been putting off. Again we consider this just part of *a sound, sane safety program, of genuine value in conserving man power.*

Another experiment we made last winter was giving oral vaccine to 112 of our older trainmen. The results were so striking in reducing lost time that we are going to continue the experiment this year with this same group and in addition apply it to a group of 80 men in another department.

Because we found so many of our men in debt to loan sharks, we established eight employee credit unions under federal charters. These unions have 3447 employee stockholders and nearly $200,000 in deposits, which is almost constantly on loan. Today company advances to employees in distress amount to $2,500 where it was $25,000 a few years ago. We found that these employee credit committees soon knew a bad risk and were much harder-boiled than the company. Yet any deserving employee now knows he can borrow in reasonable amounts and at reasonable rates of interest.

The men who work for you are far more important than your construction programs or budget problems; give more thought to them and their welfare and happiness. Don't patronize them. Treat them as you would want to be treated. It would help labor relations and safety tremendously if executives would leave their offices more frequently and get out into the shop or on the job and get their hands dirty and maybe a smudge of grease on their faces. *There is too much distance between top executives and skilled workmen.*

Labor union contracts are no bar to deserving and winning employee loyalty —quite the contrary if properly handled.

But in spite of all the safety organization and all efforts to carefully select and train men, human nature being what it is and our business being what it is, there will be accidents. What then? Shall we say there is nothing to this

safety business? No, if we are made of the right stuff we'll carry on. But what of the man permanently disabled on the job? Will you stop with the letter of the law, paying him the exact amount demanded by the Workmen's Compensation Act? *How you treat these men will have a tremendous influence on all employees.* Do they know that you go way beyond the letter of the law? That you try to rehabilitate the man and fit him into some other job? We consider this a very real part of safety.

I am thinking right now of a case where a man cut into a "hot" cable and was terribly burned around the legs. He was in the hospital over three years. The expense was enormous. The company paid it. The company not only paid all compensation called for by the law, but set him up in business at his request, and when the business failed, gave him a course in accounting. But he wasn't fitted to be an accountant. Finally we took him back as a telephone and trouble clerk. Today he is doing a fine job as chief telephone operator in the system load dispatcher's office—a happy, satisfied, responsible employee. Were the thousands of dollars we spent beyond the letter of the law wasted? I think not. Every lineman and helper is proud to work for such a company. I could tell you of similar cases of rehabilitation and fitting crippled men into jobs, but I think you get what I mean.

"Gold," the old prospector says, *"is where you find it." But Safety is where you make it.*

Safety ultimately implies responsible men and women, satisfactorily adjusted to their positions in life, contented with their work. They have been trained to look out for themselves and their fellow workmen. These people are good citizens and neighbors. People of this sort have pride in their jobs and in doing their work well. They are the essence of a successful business. Individually and collectively, they have character, a quality which you cannot buy, though you can hire any number of people.

So we are convinced of the value of Safety as a means of conserving man power!

Preparedness and National Defense are a definite challenge to American Business. A challenge to the free enterprize system that we have been so proud of. It is a challenge also to management and to labor.

Let us all utilize every means at our command and toil together safely to protect all that America stands for!

Utilization Voltage Terms and Definitions

IT is generally agreed that there is need for an approved set of terms and definitions which may be used in discussing utilization voltage problems. found on distribution circuits and for discussing utilization voltage problems. With this in mind the Subcommittee on Utilization Voltage Terms and Definitions was appointed in May, 1939, to serve under the joint sponsorship of the Transmission and Distribution Committee and the Electrical Equipment Committee, Edison Electric Institute.

This subcommittee has formulated a set of voltage terms and definitions which have been revised from time to time to take into consideration a number of comments which have been received by correspondence and in general committee meeting discussions. Comments have in general been favorable and essentially limited to two items:

1. Discussions as to the best time interval to be used for defining maximum and minimum voltages, and
2. Comments with regard to the possible simplification of the definitions.

The general comments on these definitions seem to indicate that a five minute interval is preferable to a 15 minute interval in defining maximum and minimum voltage conditions.

Much favorable comment has been received by the committee in regard to the method of measuring maximum and minimum voltages by means of a specially constructed and calibrated watthour meter, which was developed by Mr. Stanley Stokes. A number of these special voltmeters have been constructed by the Westinghouse Electric & Mfg. Co. and it is hoped that different operating companies throughout the country will purchase and give this type of voltmeter a trial. This meter is explained in the Westinghouse instruction leaflet No. 42-103. Ten of these meters have been purchased to date by four operating companies.

Although no definite action has been taken toward the general adoption of any set of utilization voltage terms and definitions, this subcommittee has been asked to submit a list of terms and definitions to be used tentatively in the study of utilization voltages, which is now being made by the Transmission and Distribution Committee.

UTILIZATION VOLTAGE TERMS AND DEFINITIONS

(Tentative List—October, 1940)

The following voltage terms and definitions are suggested for tentative use in describing the voltage conditions on distribution circuits.

Definitions of Location

DEFINITION 1. "(X) *Utilization voltage"* is the voltage measured at the terminals of the machine or device (X).

DEFINITION 2. *"Service voltage"* is the voltage measured at the terminals of the service entrance switch.

Definitions of Description

DEFINITION 3. *"Average voltage"* is the arithmetical average of the voltage existing during the period of time in question.

DEFINITION 4. *"Quadratic mean voltage"* is the root mean square of the voltage occurring within a designated period. In symbols, if T is the time interval and E(t) the voltage at time t, the quadratic mean voltage:

$$E_{qm} = \left(\frac{1}{T}\int_0^T E^2(t)dt\right)^{\frac{1}{2}}$$

DEFINITION 5. *"Maximum voltage"* is the greatest 5 minute "quadratic mean voltage," (or "average voltage" if Definition 3 is used) subject to a proper time lag.

DEFINITION 6. *"Minimum voltage"* is the least 5 minute "quadratic mean voltage" (or "average voltage" if Definition 3 is used) subject to a proper time lag.

DEFINITION 7. *"Voltage spread"* is the difference between the maximum and minimum voltages.

Definitions of Reference Levels

DEFINITION 8. *"Rated (X) voltage"* is the voltage or voltage range for which the machine or device (X) is designed to operate. It will be considered as equivalent to the voltage or voltage range appearing on the name plate.

DEFINITION 9. *"Nominal voltage"* is a fixed reference level of "service voltage" for a system.

Net Revenue the Sales Objective

By C. E. Greenwood
Commercial Director, Edison Electric Institute

SPENDING and more spending by Government in the nation's war emergency translates into spending by the light and power companies as important cogs in the preparedness machine. A substantial margin of power capacity for emergency needs now available is being increased even more. The Government obtains money for its expansions through tax levy on business and individuals. It does not earn dividends. The power company obtains its borrowed capital from investors in its securities, and it must pay a fair return on it, otherwise the source dries up.

Again the power company is a unit of business which supports a high tax burden even in normal times. It could take the rap of skyrocketing taxes with other trades were it not for the crack-down of state and local regulatory bodies on the price it can charge for its product. The motive back of many of these regulations is political rather than economic. However, it results in the utility meeting a real obstacle to prosperity because of limited gross profits from the sale of electricity.

Besides these major difficulties of abnormal taxes and restricted profit margins, well-known to readers of the BULLETIN, other mounting expenses in the field of operation could be enumerated. But they all add up to the logical conclusion that increased expenses must be balanced with increased gross and net revenue. Here is where the Commercial Departments step in to register super performance. They sell the way out.

There was once a fallacious theory in the light and power industry that business just came in the office door—the main office of course—and people who wanted electricity would be given efficient and courteous service. The very managements that reasoned that way often claimed that the utility was not a monopoly.

Those days have passed. Not only the utility, but all industry has awakened to the situation that business in this country has been long on production and short on distribution. Utility managements have learned from experience that the production and sale of electricity is a highly competitive business. People do not jam the doors to buy unless they are influenced to buy a specific service. A normal amount of business may come in, but the "normal" does not pay dividends.

It's that everlasting VOLUME of the products of utilization that registers progressive strength, and obtaining that volume is a utility sales obligation. It is a sizable job, one with ever expanding horizons. This object lesson was learned by privately owned utilities some years ago. Government owned projects learned their lesson soon after they were entrenched in business. In order to justify their existence they adopted merchandising methods to catch up which were based on expediency rather than on sound merchandising principles, this despite the advantages they enjoyed over private industry.

In the volume of new business represented in Gross Revenue, there is the so-termed profitable and unprofitable business. That is, one kind produces greater return per kilowatt than another class, and here the sales force enters with an obligation to concentrate with greater intensity on the sale of high load factor business. More new business on present capacity; putting idle services to work; reviving interest of consumers in the use of idle equipment is all a part of the general scheme to produce greater net revenue in times of soaring operating expenses.

In a recent "Question and Answer" broadcast on Economic Preparedness at the Waldorf-Astoria Hotel in New York, Mr. George Denney acting as Moderator, asked Mr. Kettering, Vice-President of General Motors Corporation, if the country could go along at this time on the basis of "Business as Usual." Mr. Kettering pointed out that the present Defense Program does not necessitate any immediate drastic adjustment. Unusual business is the immediate requirement and until unusual business is organized he thought it very foolish to curtail regular business efforts. Added Mr. Kettering, "Just keep on going until the thing gets properly organized and in the mills, then we will have to adjust ourselves to meet the requirements as they are of the day instead of trying to pre-suppose just what is going to happen."

Now it was the basic thoughts expressed in the foregoing paragraphs that were in the minds of the commercial people in drawing the scopes of activity for the work of the commercial committees of EEI for the coming year. The first meeting of the General Sales Committee was called on October 4 at Hot Springs, Va. Chairman R. E. Fisher, Vice-President of Pacific Gas & Electric Co., San Francisco, who was introduced in the September issue of the BULLETIN as the new Chairman of the General Sales Committee, presided at the meeting. In his opening remarks Mr. Fisher said: "The objectives of Sales should be carefully reviewed this year in the light of the National Defense Program and the current status of the industry, to make certain that they plumb with the needs which exist, the Committee's responsibilities, and the interests of the customers the industry serves.

"National Defense demands placed upon the utilities must be met at all costs and a special committee is proposed to study the various sales problems raised by the emergency, to coordinate any activities bearing upon the problem, and to counsel with and guide the membership.

"Broadly speaking, except insofar as there may develop conflict with the national defense needs, the General Sales Committee should sponsor and encourage a more aggressive and effective selling program than ever in all classifications. An attitude evidenced in some quarters to curtail or eliminate sales activities, in view of expected industrial load increases, is not in the best interest of the private utilities. Every effort should be made, as public interest is diverted to national and international affairs, to refocus attention and recreate conviction in the public mind that the private utilities are alive to their responsibilities and are discharging them satisfactorily to the best interests of all concerned. I would suggest the watchword ELECTRI-

FORTIFY which should apply to the customer as well as the private utility industry."

And therefore we go forward in Edison Electric Institute with a well rounded program, an idea of which may be gained by brief reference to the thinking of both the organizational committees and the joint committees on National Program.

National Sales Defense Committee (Edwin Vennard, Vice-President, Middle West Service Corp., Chairman)

A special committee was created by Chairman Fisher of the General Sales Committee to obtain essential information in connection with the service supply for emergency defense projects and to tie-in with other groups in situations effecting commercial activity.

Power and Heating Sales Committee (C. H. Purdy, Consumers Power Co., Chairman)

Of outstanding importance in the plans of the power group is the production of a Sales Manual consisting of fourteen chapters, for the information and training of the men on the firing line in the power sales field. The need for such a sales help has been recognized over a long period and former power committees have given it thought and attention.

With the completion of seven chapters and remaining ones in the hands of an editing committee, there is assurance of the availability of this Manual in the near future.

The Committee has concluded to hold the Annual Power Sales Conference at Chicago in conjunction with the General Sales Conference which is to be at a time and hotel to be later announced.

The schedule of activities includes numerous other studies of the competitive field of power supply; the investigation of new processes such as the application of infra-red lamps, and electric welding applications in industrial production which will, without question, show rapid increase.

Home Lighting Equipment Sales Committee (Harry Restofski, West Penn Power Co., Chairman)

Supplementing the effective promotional activity of the Better Light-Better Sight Bureau in promoting the educational and social aspects of light in its relationship to eyesight conservation, this Committee of the Institute functions in stepping up the sales tempo of lighting equipment which has lagged behind the promotion of the Bureau. It is gratifying that manufacturers of equipment are realizing more and more the obligation of producing types through which higher intensities can be obtained scientifically.

The Committee aims to create greater utility appreciation of the importance of the home lighting market; to stimulate greater interest through increased publicity, and to inspire more active selling locally.

Recognizing the value of national contests in all promotion, the Committee has under advisement a tie-in with other industry groups in a major contest in which many utilities will without question participate. Information on the prize money and terms and conditions will be distributed. An interchange of sales methods and the results of local promotions will be arranged.

Lighting Sales Committee (S. L. Drumm, New Orleans Public Service Inc., Chairman)

There are always questions of moment in the lighting classification of electric service which need investigation and study. Continuing the excellent work of last year's Committee in connection with information on new light sources, Chairman Drumm has outlined a follow-up on the status of fluorescent lighting. This form of illumination is here to stay and the period of adjustment requires accurate records on which to form conclusions. Should a type of utility responsibility be initiated to hasten the development of better fluorescent lighting equipment and application methods? What is to be done concerning power factor clauses? How will the records be kept and what will be the load losses as fluorescent lighting gains in popularity? What should be done in regard to high tension tubing being used in interior lighting? These are all questions for consideration of the Committee.

The possible need of development for promoting street and highway lighting will be taken under advisement. More effective contacts with architects, engineers and building owners and managers are further subjects for attention of the Committee.

The all-important interchange of information on lighting promotion activities will be included in the scope of Committee effort.

Farm Sales Committee (F. A. Coffin, Vice-President, Wisconsin Electric Power Co., Chairman)

The obligation of the private utility companies to earn some return on the hundreds of millions of dollars invested in rural lines still obtains. The selling to the farmer of equipment and service requires painstaking planning. One of the purposes of the Committee is to act as a clearing house for sales methods and results. Equipment will be studied for its applicability and, generally speaking, effort will be focused on those farm sales that will help the farmer to help himself.

The utilities have held leadership in the field of rural line extension, and ways and means should be found for the utilities to frankly tell the farmer their part in rural electrification development. There is a public relations angle as well as a commercial motive in committee procedure.

The program includes contact and information with agencies identified with farm problems together with the production of promotional material that will be of value in business building.

Utility-Dealer Sales Committee (R. P. Wagner, New York Power & Light Corp., Chairman)

Judging by the experiences of such electric utility companies as have given up the direct selling of domestic appliances and turned it over to the dealer, it has become evident that dealers as a class have not the training to fit them for productive sales volume. While the utilities were responsible for approximately 15 per cent of the money volume of household appliances in 1939, a substantial portion of the recorded sales by dealers was created by utility sales people. The job ahead is to help the dealer to be independent in his selling. At present he leans upon the utility for both promotional and sales help.

As one means of overcoming this obstacle, the Utility-Dealer Sales Committee is in process of developing an educational course with combination of sound slide films and written text. The proposed series of ten records would include five of general sales character, and each of the others would cover a sale of a specialty such as refrigerators, ranges, water heaters, washing machines, vacuum cleaners or the small appliance group. This will be a joint effort of Edison Institute and other associations. A second feature of the committee program is a study of dealer-utility relationship in appliance load building which will include investigation of the experiences of the light and power companies under different merchandising practices.

Air Conditioning Committee (H. H. Mather, Philadelphia Electric Co., Chairman)

There is much to be learned about the air conditioning load and compensation in rates for the service. The Annual Statistical Survey which will be published by the Committee again this coming year will indicate as in the past a constant growth in the extent in application of air conditioning equipment.

There appears to be a large potential market for portable room coolers, especially for bedrooms in the home and for offices and other commercial uses. The Air Conditioning Committee is consulting with the manufacturers in the hope of obtaining ratings on such room coolers on a uniform basis. Progress is being made, and without question the information can be disseminated to utilities before the 1941 cooling season.

The Committee intends to gather economic data to be used as a selling tool for salesmen of the equipment manufacturer as well as the utility. Additional data will be compiled on air conditioning installations using other than electrical energy for cooling purposes.

The Committee is mindful of the need for further research in connection with the application of air conditioning and its effects on the health of those whom it serves, and will forward the effective work that is now being done at various sources.

Household Appliances Committee (M. R. Rodger, Middle West Service Co., Chairman)

The time is ripe for the industry to devote effort to the promotion of household appliances. There must be an evaluation of the load building value of this class of equipment in the light of present conditions. Mr. Rodger points out that the policy changes of utility companies in giving over the small appliance business to the dealers has been accompanied generally by a decrease in promotional effort on the small appliance line. The activities of utility companies in all-employee campaigns to increase the sale of the table cookery and the laundry group have been retarded by conditions beyond control of the company. There has been a general let-down in advertising and promotion, and even in display of the "traffic" group of appliances.

Part of the program of the Committee will be to revive new interest in this forgotten group and devise ways and means to produce volume selling. The subject is an important one and justifies the complete review of the present status of load building with small household appliances, and suggestion of remedial measures to bring them back to their rightful place in the sun.

Wiring Committee (G. W. Hart, Ebasco Services, Inc., Chairman)

Previous activities of the Wiring Committee have been primarily along technical lines and a strong background has been built up for powerful and promotional effort to establish adequacy in wiring in commercial and industrial structures. Code approval of thin-wall insulation has been the sounding board for an educational campaign among all interested groups to point out the benefits to be obtained from these Code changes. The Committee will now emphasize the promotional phases of adequacy through the use of these new wiring materials and methods. One should bear in mind that the use of CNX and bare neutral wiring is possible for test purposes, with local inspection approval, although not included in the recent Code revisions.

The Committee will complete the production of sample kits of new thin-wall insulated conductors to be used in promoting commercial and industrial rewiring. These kits will shortly be available. A Kodachrome slide film talk on residential wiring materials and methods is now in process of building and the Committee hopes to have it completed for early use. Consumer direct mail pieces are proposed; regional conferences on wiring; and very important, an organized plan of coordination of the entire wiring program which will include contacts with other associations who have a common concern in the broad development of adequacy in commercial and industrial wiring. Numerous other organizational changes are under advisement in order to bring about a year of successful achievement.

Other Committees

A Committee on Electric Water Heating Service, and equipment to be recommended for it is in process of organization. A new committee which is being organized by Chairman Fisher of the General Sales Committee will have Home Service as its field. The scope of effort of these committees, and the Chairmen appointed will be announced in a later issue of the BULLETIN.

NATIONAL PROMOTIONAL PROGRAMS

Modern Kitchen Bureau (W. H. Sammis, Vice-President, Commonwealth & Southern Corp., Chairman)

The report of Mr. Sammis on the Modern Kitchen Bureau was convincing proof that the Bureau is a going concern and giving a splendid account of itself in achievement. In recent issues of the BULLETIN there have appeared articles on the activities of the Bureau which cover the promotion of the modern electrified kitchen as a background to the individual campaign activities on electric cooking, water heating and refrigeration. The extent of the acceptance of this Modern Kitchen Bureau program is indicated in the report that range campaign material was used by utilities having a total of more than 13,000,000 meters; water heater material by utilities having 10,000 meters, and refrigerator material on the properties of utilities having 4,500,000 meters. Approximately 125,000 items of material were purchased for the over-all kitchen campaign. The electric roaster was included as an electric cooking item in the kitchen in 1939 and approximately 66,000 pieces of promotional material were used by the local utilities.

Sales of appliances the Bureau is promoting have had a remarkable increase during the first six months of 1940. Ranges are up 34 per cent, and it is expected that the ALICE IN ELECTRI-WONDERLAND Fall campaign will sharply increase these totals. Refrigerators are up 32 per cent. Water heaters led by Donald Duck, the fanciful character used in the water heater campaign, have increased sales 18 per cent.

National advertising will continue throughout the Fall on ranges and water heaters. The Bureau now has under advisement its program for the coming year.

Commercial Electric Cooking Council (J. F. Porter, Jr., Vice-President, Kansas City Power & Light Co., Chairman)

There has just been completed at Chicago the Fourth Annual Commercial Electric Cooking Conference. This was held during National Restaurant Week and again attention was focused on this classification of business. A closer understanding between the utilities and the food service equipment dealer is strongly evident as a result of the Council activity over the past three years. The program and speakers indicated broad thinking, and were convincing of the steady gains being made in the sale of electric cooking equipment in commercial and industrial establishments.

Although the Council was organized to give specific attention to counter and pantry devices, Chairman Porter realized the need of including the entire line and the scope of consideration was widened. At a recent meeting of the Executive Committee preceding the National Conference, final arrangements were made for the completion of the Sales Manual and its early publication. Two new promotional pieces were presented by the Plan Committee and approved. The circulation of the monthly news sheet BUILD PROFITS has been increasing in its appeal to local utilities for distribution to customers and prospects and this will be continued and enlarged.

Annual Sales Conference

The tentative dates of March 31-April 4 have been set for the 1941 National Sales Conference which will be held as usual at Chicago.

Personnel General Sales Committee 1940-1941

Chairman, R. E. FISHER, Pacific Gas and Electric Co., San Francisco, Cal.

Vice-Chairman, EDWIN VENNARD, Middle West Service Co., Chicago, Ill.

A. A. BROWN, Oklahoma Gas & Electric Co., Oklahoma City, Okla.

F. A. COFFIN, Wisconsin Electric Power Co., Milwaukee, Wis.

C. A. COLLIER, Georgia Power Co., Atlanta, Ga.

R. D. CUTLER, Hartford Electric Light Co., Hartford, Conn.

D. M. DEBARD, Stone & Webster Service Corp., New York, N. Y.

H. E. DEXTER, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.

S. L. DRUMM, New Orleans Public Service, Inc., New Orleans, La.

L. L. EDGAR, Boston Edison Co., Boston, Mass.

R. H. FITE, JR., Ebasco Services, Inc., New York, N. Y.

H. J. GALLAGHER, Consumers Power Co., Jackson, Mich.

GEORGE W. HART, Ebasco Services, Inc., New York, N. Y.

E. F. JEFFE, Consolidated Edison Co. of New York, Inc., New York, N. Y.

E. H. KELLY, Central Illinois Public Service Co., Springfield, Ill.

H. H. MATHER, Philadelphia Electric Co., Philadelphia, Pa.

A. D. McLAY, The Detroit Edison Co., Detroit, Mich.

C. E. Michel, Union Electric Co. of Missouri, St. Louis, Mo.

G. E. MILLER, Cleveland Electric Illuminating Co., Cleveland, Ohio.

J. E. NORTH, The Cleveland Electric Illuminating Co., Cleveland, Ohio.

J. F. PORTER, Jr., Kansas City Power & Light Co., Kansas City, Mo.

P. H. POWERS, West Penn Power Co., Pittsburgh, Pa.

C. H. PURDY, Consumers Power Co., Jackson, Mich.

HARRY RESTOFSKI, West Penn Power Co., Pittsburgh, Pa.

M. R. RODGER, Middle West Service Co., Chicago, Ill.

W. H. SAMMIS, The Commonwealth & Southern Corp., New York, N. Y.

H. M. SAWYER, American Gas & Electric Service Corp., New York, N. Y.

M. E. SKINNER, Buffalo Niagara & Eastern Power Corp., Buffalo, N. Y.

H. P. J. STEINMETZ, Public Service Electric & Gas Co., Newark, N. J.

R. H. TILLMAN, Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

R. P. WAGNER, New York Power & Light Corp., Albany, N. Y.

G. E. WHITWELL, Philadelphia Electric Co., Philadelphia, Pa.

H. E. YOUNG, Northern States Power Co., Minneapolis, Minn.

Specifications Suggestions for Transmission and Distribution Materials

A new "Suggestion for Specifications" covering Straight Tinned Copper Conductors, sponsored by the Standards and Specifications Group of the Transmission and Distribution Committee was published by the Institute in September, and two more, covering Types A and B Untreated Douglas Fir Crossarms, will be published this month.

The publication of these specifications brings the total number prepared under the sponsorship of the Standards and Specifications Group to eleven, most of them superseding previous "Suggested Specifications" published by the N.E.L.A. Others are now in preparation and will be published when completed.

It is believed that a general use of these "Suggestions" will be of advantage to both companies and manufacturer in promoting simplification and uniformity of requirements and of products.

The "Suggestions" are priced at 10 cents per copy. Those published to date are listed below:

TD-1 BOLTS AND NUTS. Covers machine bolts, double arm bolts, carriage bolts, guy clamp bolts and nuts and other small bolts commonly used in overhead line construction. Supersedes the following N.E.L.A. specifications: D209-22; D235-22; D240-22; D243-22; D246-22 and D250-22. (Published May, 1937.)

TD-2 ANCHOR RODS. Covers the anchor rods commonly used in overhead line construction. Supersedes the following N.E.L.A. specifications: D261-24; D262-24 and D263-23. (Published April, 1939.)

TD-3 LAG SCREWS. Covers lag screws commonly used in overhead line construction. Supersedes the following N.E.L.A. specifications: D265-22; D266-22; D264-28T and D264.1-28T. (Published October, 1938.)

TD-4 EYE BOLTS. Covers the eye bolts commonly used in overhead line construction. Supersedes the following N.E.L.A. specifications: D255-22 and D257-23. (Published April, 1939.)

TD-6 STEEL CROSS ARM BRACES. Covers steel braces commonly used in overhead line construction. Supersedes the following N.E.L.A. specifications: D220-22; D225-22; D227-22; D228-22; D230-27; D231-27; D220-28T; D225-28T and D230-28T. (Published May, 1940.)

TD-8 STRAIGHT TINNED COPPER CONNECTORS. Covers straight tinned copper connectors commonly used in underground construction for round concentric, round compact, sector and sector compact stranded cables and AWG sizes 4 and 6 solid wire. Supersedes tentative specifications in N.E.L.A. Report 090. (Published September, 1940.)

TD-10 ROLLED STEEL WASHERS. Covers flat, round, and square rolled steel washers commonly used in overhead line construction. Supersedes the following N.E.L.A. specifications: D270-22; D275-24; D276-24 and D270-28T. (Published May, 1940.)

TD-51 LOW AND MEDIUM VOLTAGE PIN TYPE INSULATORS. Covers pin type insulators made of porcelain or of glass and having a dry flashover of 85,000 volts or less. Supersedes the following N.E.L.A. specifications D510-23; D511-23; D590-23; D591-23 and D592-23. (Published September, 1937.)

TD-61 TYPE A UNTREATED DOUGLAS FIR CROSSARMS. Covers Type A untreated crossarms made of Douglas fir. Type A is based upon standard crossarm stock. This specification is limited to crossarms having a cross section of not more than five inches on one face by not more than six inches on the other face. Supersedes the following N.E.L.A. specifications: D100-24; D109-28T; D110-22T; D111-22T and D112-22T. (Published October, 1940.)

TD-62 TYPE B UNTREATED DOUGLAS FIR CROSSARMS. Covers Type B untreated crossarms made of dense select structural grade of Douglas fir. Type B is more liberal in respect to knot and check limitations but presupposes timber that is stronger. This specification is limited to crossarms having a cross section of not more than five inches on one face by not more than six inches on the other face. (Published October, 1940.)

TD-71 INSULATOR AND PIN THREADS AND GAUGES. Supersedes the following N.E.L.A. specifications: D990-28T; D991-28T; D992-28T; D993-28T; D994-28T; D995-28T; D996-28T and D997-28T. (Published September, 1937.)

National Accounting Conference to Be Held at Detroit

Joint Meeting of AGA and EEI Groups—Attendance expected to exceed last year's high of 700

THE Accounting Committees of the American Gas Association and the Edison Electric Institute will hold the 4th National Accounting Conference at the Book-Cadillac Hotel, in Detroit, Michigan on December 2, 3 and 4, 1940.

For the past six weeks, the accountants of the gas and electric companies have been going full steam ahead with plans. Reflecting the mutual belief that accounting activities of both industries, will benefit greatly through co-ordination of research on common problems, this year's conference will bring together the corresponding accounting groups of the two associations. Considerable emphasis is being placed on separate meetings of specialized groups, but the two general sessions have been planned to capture and hold the interest of visitors concerned with public utility accounting in any of its branches.

To insure maximum efficiency in the selection of the speakers and subjects for this year's program, chairmen E. N. Keller and G. H. Bourne, leaders of the accounting activities of the gas and electric utility associations, have appointed a Planning Committee headed by those two old war horses, Frank Flahive and Barney Rodey. They are being aided by seasoned veterans from both associations.

The fact that this National Accounting Conference is being jointly sponsored again this year is eloquent testimony of the esteem with which it has come to be regarded by the nation's accountants, both inside and outside the two industries directly concerned.

The cooperation by the gas and electric utility accountants will undoubtedly promote efficiency in accounting research. This appears especially true with regard to the many combination companies whose accountants are active in the two associations. Too, coordinated effort will stimulate more widespread response and will, it is hoped, give greater weight to the views and opinions worked out in this way. Judging from the eager interest already displayed, last year's attendance of over 700 will be substantially exceeded this year.

IMPORTANT

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Registration: Opens Sunday, December 1, at 1 p.m.; Monday, Tuesday, Wednesday at 8:30 a.m. Desk near ballroom. Fee for the entire Conference, $2.00.

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Reservations: Make them *early* with the Book-Cadillac Hotel, Detroit.

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Dinner: Informal, on Tuesday evening, December 3. Major Alexander Forward, AGA, toastmaster. Dean John T. Madden, New York University, principal speaker: "Accounting Eugenics." Unique entertainment. *Get tickets* for dinner and for luncheon conferences near registration desk.

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Everyone interested in public utility accounting is cordially invited to attend all Conference sessions and the dinner.

Conference Chairmen Granville Bourne and Roy Keller

PRINCIPAL THEMES OF THE CONFERENCE

The general sessions will concern the broader non-specialized aspects of utility accounting. The principal theme this year, in keeping with the time honored practice in all branches of the utility industry, will be the matter of ways and means for reducing costs. Rising costs, particularly accounting costs brought about by the injection of enhanced regulatory requirements, have made it imperative that something be done to offset these additional operating expenses, if the industry is to continue another time-honored practice—that of reducing rates to its customers. In addition, our national defense program requires a strict husbanding of our national resources, which is impossible without air-tight accounting. Needless to say, however, there will be no slighting of perennial friends—taxation, plant accounting and original cost problems and last, but by no means least, depreciation. A dissertation on Americanism is sure to be both timely and inspiring.

More accounting information for the rate engineer

Rates and rate structures occupy an important place in the utility industry. Are there any gaps and deficiencies in rate structures that may be disclosed by accounting analysis? There must be a scientific approach by utility accountants to insure the fullest cooperation in a field so important not only to revenue, but perhaps even more to public relations.

Is the functional approach the answer to the accountant's prayer for simplifying internal reports?

It is only natural that classifications required by public service commissions have been compiled with an

eye to the needs of the regulatory authority. The accounting information needed by management may involve additional reports. It is essential that the huge expense of duplication and overlapping accounting work be reduced as far as possible. What can be done toward developing a classification that will satisfy the demands of both companies and commissions?

Benefits from Original Cost Requirements—if any

Our industries have spent huge sums to determine their original cost. What has been gained from this accomplishment? How can this data be used to best advantage by managements? What problems are involved in preserving this investment and obtaining maximum returns in the form of future usefulness? Does the cost of the perpetuation of such records offset any benefits to management?

Depreciation—practice and theory

The time has come for a reexamination of the fundamental bases of our thinking on depreciation. Have regulatory concepts perhaps "gone off on a tangent"? The stake of our industries in the right solution is three billions—*billions, not millions* of dollars.

"Accounting Eugenics"

There is hardly a utility accountant who has not been hampered in his work by lax or unscientific accounting of the past. The practices of today determine to a surprising degree the accounting health and the accounting expenses of tomorrow. This relationship will be discussed by a man of nation-wide repute, from whom we all can learn.

In short, utilizing the experience of last year's general session, the objective of the planning committee has been to arrange a program distinguished by its unusual quality and timeliness of subject matter.

SPECIALIZED GROUP MEETINGS

The planning committee has placed considerably more emphasis this year on the character and detail of the separate group meetings. There will be more than the presentations of formal papers. All the group chairmen have promised to provide for, and encourage, sponsored informal discussions. Some of these groups are also arranging luncheon conferences for Tuesday afternoon. These meetings will include conferences of the following groups: Customer's Relations, Commercial Accounting and Collections; Depreciation; Plant Accounting and Records; Classification of Accounts; and other General Accounting activities.

AREN'T WE ACCOUNTANTS FAILING TO GIVE THE RATE ENGINEER *ALL* POSSIBLE NEEDED INFORMATION?

•

IS THE FUNCTIONAL APPROACH THE ANSWER TO THE ACCOUNTANT'S PRAYER FOR SIMPLIFYING INTERNAL REPORTS?

•

BENEFITS FROM ORIGINAL COST REQUIREMENTS —IF ANY.

•

HOW DO REGULATORY CONCEPTS AND PRACTICES OF DEPRECIATION SHOW UP UNDER THE MICROSCOPE OF LOGIC AND REASON?

•

ARE YOU QUITE SURE ABOUT YOUR ACCOUNTING HEALTH? WHAT DO YOU KNOW ABOUT "ACCOUNTING EUGENICS"?

•

CURRENT EVENTS NOTWITHSTANDING, WE ARE TO HAVE A TALK ON AMERICANISM

•

These are only a few of the many interesting and important problems to be discussed at the Fourth National Accounting Conference in Detroit.

Customer Activities

The plans of the Customer Accounting and related groups are already well advanced, and will deal with the following topics:

(1) Customer Sampling Procedure
(2) Credit and Collections
(3) Education of Commercial Employees
(4) Alphabetic - Numeric Punch Card Billing & Tabulating
(5) Punch Card Cash Stubs and other recent developments in this field.

The Customer Activities Group plan to have a full discussion of the above papers at the general session on Monday, December 2, and have scheduled three separate luncheon meetings for Tuesday noon followed by informal discussions of these and other timely problems. This group is also considering a planned tour of the accounting plants of both the Michigan Consolidated Gas Company and The Detroit Edison Company.

Following the recent organization meeting of the accounting committee of the American Gas Association, the plans for this group meeting are being worked out under the leadership of D. E. Maloney, chairman, Customer Accounting; Harold Quad, chairman, Customer Collection, and Harry Jeffs, chairman, Customer Relations, with J. A. Williams, coordinating the work of the three AGA Customer Activities groups, who is working with L. A. Mayo, Chairman of the EEI Customers' Relations, Commercial Accounting and Collections Committee.

Depreciation Committee

The difficult subject of depreciation will be in the hands of H. L. Gruehn and H. C. Hasbrouck, Chairmen. This assures a program arrangement that will present novel and interesting aspects of a timeworn but tremendously important field. Accountants who specialize in depreciation, and executives interested from a management viewpoint will not want to miss these sessions. Advance information indicates that some of the subjects to be dealt with are (1) presentation of depreciation testimony (2) glossary of depreciation terms (3) straight line depreciation as such (4) what depreciation is not (5) why future service life may differ from past experience (6) variations in the accrual of obsolescence with growth of business cycles (7) average service life, its determination and forecast (8) principles of depreciation, etc.

Plant Accounting

Under the capable leadership of H. B. Hardwick and E. F. Wressel, Chairmen of the Plant Accounting Committees of the EEI and AGA respectively, formulation of an interesting program for this group session is well under way. Subjects planned for discussion include a plan for perpetuating results of original cost record, standard cost theories, over-itemization of property records, fields of reducing plant record cost, acquisition adjustment problems and methods of handling maintenance associated with new construction.

The proper allocation of cost of replacement projects and indirect and overhead construction costs will come up for renewed discussion. The committee will concentrate on two phases, namely, methods for handling general and administra-

(*Continued on page* 496)

Diversified Demand Method of Estimating Residential Distribution Transformer Loads

By C. E. Arvidson
The Commonwealth & Southern Corporation, Jackson, Michigan

A paper presented at a meeting of the Transmission and Distribution Committee, EEI, Oct. 15, 1940, Atlanta, Ga.

THE economic importance of distribution transformer loading, considered either from the viewpoint of transformer thermal ability or adequate utilization voltages or both, has long been recognized by distribution engineers. In order to maintain an adequate and economical distribution system it is necessary to employ some means of determining transformer loads. Since field load testing of residential distribution transformers is an expensive procedure, especially if the resultant data are to be reliable, several statistical methods have been devised and the one herein discussed has been referred to as the "Diversified Demand Method."

The "Diversified Demand Method" of estimating loads on residential distribution transformers originated with the Tennessee Electric Power Company and was based upon data obtained and published by the National Electric Light Association. It was tentatively adopted by The Commonwealth & Southern Corporation to be used until further tests might indicate that it should be revised or discarded. Many subsequent checks and tests to determine the reliability of this method seem to justify its continuance in lieu of the customary field testing methods.

The purpose of this paper is to discuss the "Diversified Demand Method" of estimating maximum loads on residential distribution transformers and to illustrate its accuracy by means of graphical comparison of estimated versus actual demands.

Before going into the actual mechanics of estimating residential loads, it is perhaps advisable to discuss some of their characteristics with the hope that a better understanding of these characteristics might assist not only those who intend to use this or a similar method but also those who prefer the field load testing methods.

Characteristics of Residential Loads

Residential loads consist of many combinations of various types of utilization equipment whose natural hours of use and inherent characteristics govern the time of occurrence, the duration, and the magnitude of the component demands. The resultant transformer demands, especially those including ranges, vary from minute to minute, hour to hour, and day to day, and although it is difficult to determine these peak demands by means of "spot" load checks, they can apparently be predicted with reasonable accuracy by means of statistical data.

In order to estimate the maximum demands created by residential loads it is necessary to consider two important factors:

1. The diversity which exists among various units of the same type of utilization equipment, and
2. The additional diversity which exists between different types of utilization equipment because of hourly variations peculiar to each type.

Both of these factors could be recognized by determining a family of curves for each type of utilization equipment with each curve of the family representing the diversified maximum demand for a different hour of the day. Such data however might be difficult to obtain and certainly would be cumbersome to use. A more practical method of recognizing these factors would be one having one diversified maximum demand curve for each type of utilization equipment and to discount these maximum demands by an hourly demand variation or coincidence factor when the different types of loads are to be combined.

Diversified Demand Data

The diversified demand curves shown in Figure A indicate the average maximum demand per unit (or per customer) for various numbers of units. Separate curves are shown for ranges, lighting and miscellaneous appliances, and for refrigerators. These curves are based upon the original data used by the Tennessee Electric Power Company, and many subsequent checks have indicated that no revisions are necessary. The values indicated by these curves represent the per-unit average maximum diversified demands of five minutes duration or more. Such a short time interval is necessary in order to properly recognize the demands and resultant voltage drops created by loads including only two or three ranges. In considering the demands created by several ranges or by customers having only lighting and miscellaneous appliances, the difference between the magnitudes of five-minute and of fifteen-minute demands would usually be small.

No diversity curves have been shown for water heaters, since there are many possible types of heaters as well as many different schedules of water-heating hours. Each company desiring to use this method should therefore prepare its own curves for water heaters based upon its individual operating conditions. In preparing such data, it should be kept in mind that these curves should represent the average *maximum* diversified demand per unit rather than the *average* demand per unit.

The question has been raised as to whether the demand values in Fig. A should be expressed in terms of kw or kva. These values are actually in terms of kw, but for all practical purposes they may be called either kw or kva, since, except for refrigerators, the loads are very close to unity power factor. Furthermore, when these loads combine to create the *peak* load on the transformer, the resultant *peak* load power factors usually are in the order of 95 per cent or higher, and the errors involved by

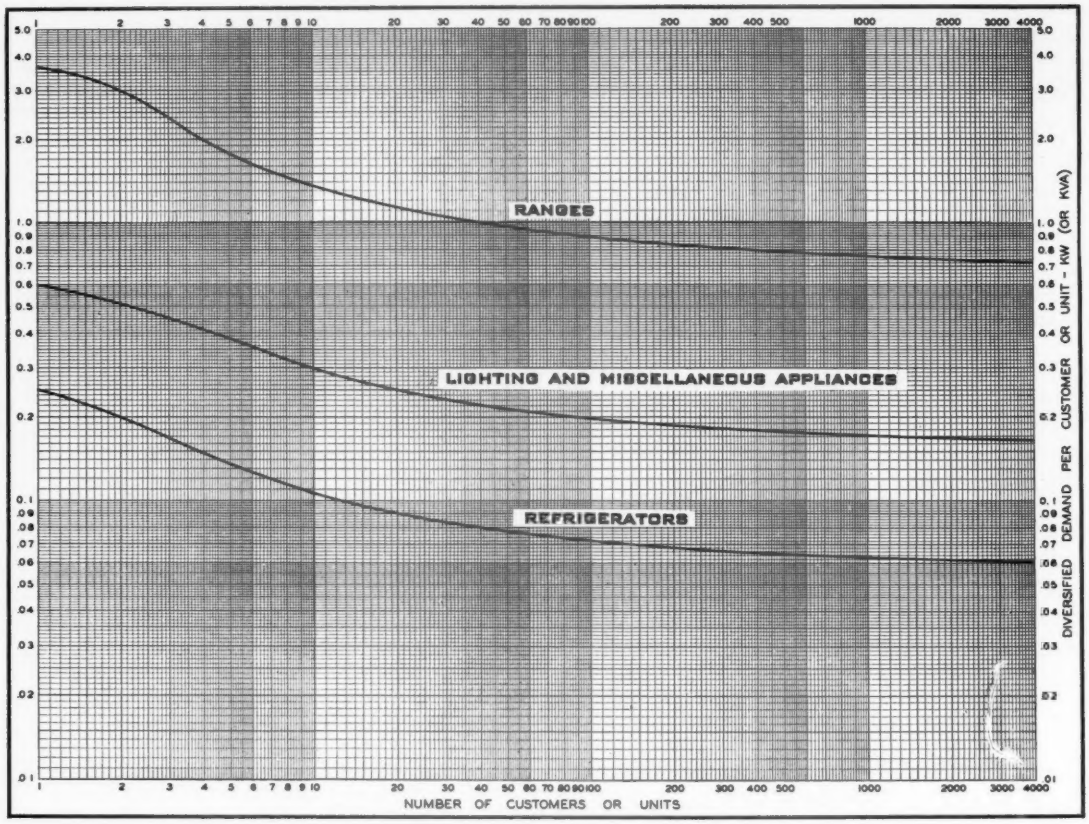
RANGES
LIGHTING AND MISCELLANEOUS APPLIANCES
REFRIGERATORS
DIVERSIFIED DEMAND PER CUSTOMER OR UNIT - KW (OR KVA)
NUMBER OF CUSTOMERS OR UNITS

Fig. A—Average Maximum Diversified Demands Per Customer.

not being theoretically accurate are usually negligible.

Hourly Demand Variation Factors

Hourly demand variation factors (or coincidence factors) were evolved to provide a method of combining the probable simultaneous demands for various types of utilization equipment in order to obtain the maximum simultaneous demand for the group. For instance, if the range demand peaks at 5:45 pm and the lighting peak comes at 7:00 pm, it must be known what portion of the maximum lighting demand should be added to the range demand or what portion of the maximum range demand should be added to the lighting demand to obtain the maximum simultaneous demand for the combined load.

Table I gives the hourly demand variation factors for ranges, lighting and miscellaneous appliances, and for refrigerators. These factors are the same as those developed by the Tennessee Electric Power Company except for slight revisions affecting principally the morning hours.

No factors have been given for water heaters for reasons previously mentioned, and each company should derive its own factors to fit its individual water heater operating conditions. These factors are determined by averaging a large number of daily kw load curves for each type of utilization equipment and plotting the resultant load curves in terms of per cent of maximum demand. Days of unusu-

TABLE I—HOURLY DEMAND VARIATION FACTORS IN PER CENT URBAN RESIDENTIAL CUSTOMERS

Hour	Lighting and Miscellaneous Small Appliances	Refrigerators	Ranges
1 AM	16	83	1
2	10	78	1
3	8	78	1
4	8	78	1
5	12	76	1
6	20	75	5
7	42	76	24
7:30	58	77	48
8	55	78	51
9	45	78	26
10	41	79	23
11	40	84	24
12 Noon	32	89	47
1 PM	30	89	24
2	33	89	15
3	36	89	13
4	44	89	21
5	69	90	62
5:45	90	91	100
6	98	92	95
7	100	98	30
7:30	99	100	16
8	98	95	11
9	85	90	6
10	69	88	4
11	50	89	4
12 Midnight	27	90	2

TABLE II—CUSTOMER DATA
RESIDENTIAL DISTRIBUTION TRANSFORMER LOAD TESTS

Fig.	Transf Size (Kva)	Total No.of Cust.	Off Peak W.H.	No. of Ranges from Survey* No. of Ranges	Coml. Cust.	Equiv. Ranges	Est(a) Demand	No. of Ranges from Kwhr** 3-Wire Services	Equiv. Ranges	Est(a) Demand	Class Territory	Type of Ammeter
1	25	31	5	11	6	17	27.9	19	13	24.2	Medium	Thermal
2	15	11	4	9	0	9	16.4	11	7	14.4	"	Graphic
3	25	47	0	4	0	4	19.0	8	5	19.7	"	Thermal
4	25	42	0	0	0	0	11.1	7	2	16.0	"	Graphic
5	15	23	0	2	0	2	12.1	6	2	12.1	"	Thermal
6	15	52	0	2	1	3	19.3	7	3	19.3	"	Graphic
7	37.5	50	3	12	0	12	27.0	32	18	32.1	"	Thermal
8	25	47	3	15	0	15	29.0	27	11	25.3	"	"
9	10	8	0	6	0	6	12.6	7	5	11.7	"	Graphic
10	5	4	2	2	0	2	7.8	4	3	9.3	"	"
11	10	16	0	0	0	0	5.1	2	0	5.1	"	"
12	25	69	1	5	0	5	24.1	9	3	22.5	"	"
13	10	19	0	2	1	3	12.5	4	3	12.5	"	"
14	10	7	0	0	0	0	3.0	2	0	3.0	Low	"
15	10	20	0	1	0	1	9.1	6	2	11.5	Medium	"
16	15	17	1	6	5	11	19.5	12	8	16.5	"	"
17	37.5	64	3	16	1	17	34.4	35	24	40.7	"	"
18	25	35	2	9	3	12	24.0	22	11	23.1	"	Thermal
19	10	23	3	4	1	5	14.8	12	3	13.2	"	"
20	10	20	0	2	0	2	11.5	2	1	9.1	"	Graphic
21	25	52	0	5	0	5	20.9	11	3	19.3	"	"
22	10	28	0	4	1	5	15.9	7	1	10.8	"	"
23	15	41	2	5	0	5	18.6	8	5	18.6	M & L	Thermal
24	7.5	25	4	7	0	7	17.4	9	7	17.4	Medium	"
25	25	104	7	18	3	21	45.4	24	21	45.4	"	"
26	25	22	0	4	0	4	13.9	5	4	13.9	"	Graphic
27	15	42	0	0	0	0	11.1	1	0	11.1	Low	"
28	10	29	0	1	0	1	10.9	1	0	8.1	Medium	"
29	25	72	0	3	0	3	23.0	10	3	23.0	"	"
30	25	71	0	0	0	0	17.4	12	0	17.4	Low	"
31	25	53	0	1	0	1	15.6	5	2	17.9	Medium	"
32	25	52	1	4	0	4	19.8	9	2	17.7	"	"
33	5	9	0	1	0	1	6.7	3	-	-	Low	Thermal
34	10	23	0	5	0	5	14.9	5	-	-	"	"
35	25	44	0	0	0	0	11.6	6	2	16.4	Medium	"
36	15	30	0	10	0	10	21.0	12	-	-	Low	"
37	10	23	0	3	0	3	13.2	5	-	-	"	"
38	25	40	0	0	0	0	10.6	5	5	18.7	Medium	"

Notes: * Equivalent Ranges equals sum of two preceding columns. Data from field survey.
** Equivalent Ranges equals number of 3-wire services having consumptions of 150 kwhr (or more) per month for December or January.
(a) Estimated demands based on 50% refrigerator saturation.

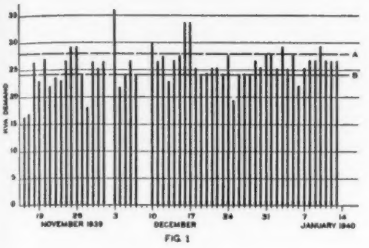

FIG. 1

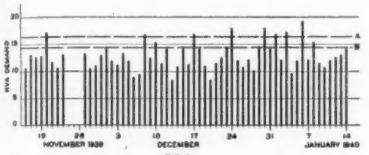

FIG. 2

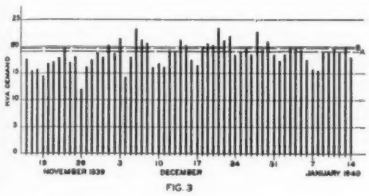

FIG. 3

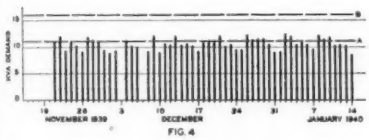

FIG. 4

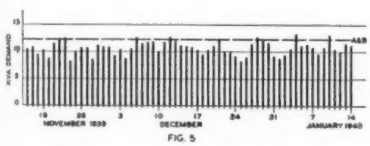

FIG. 5

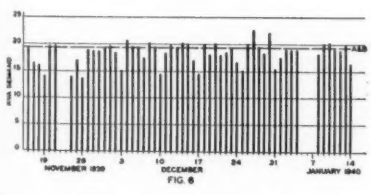

FIG. 6

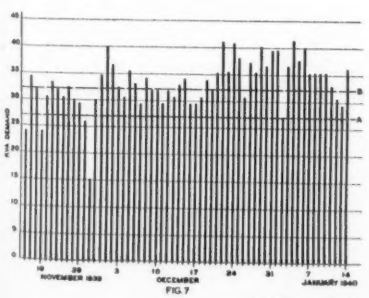

FIG. 7

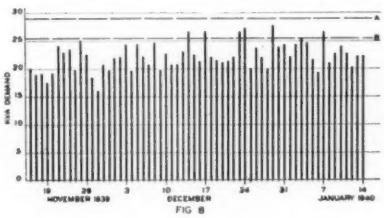

FIG. 8

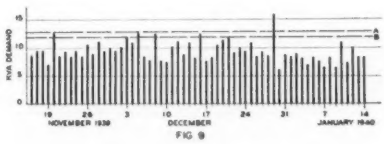

FIG. 9

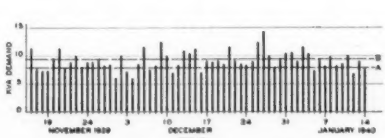

FIG. 10

FIG. 11

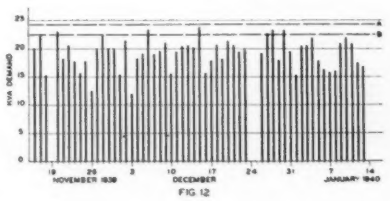

FIG. 12

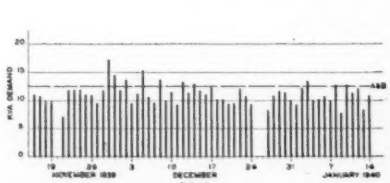

FIG. 13

A Lines Estimated Demand—Number of Ranges Determined from Survey
B Lines Estimated Demand—Number of Ranges Determined from Kwhr Consumption
Figs. 1-13, RESIDENTIAL DISTRIBUTION TRANSFORMER LOAD TESTS

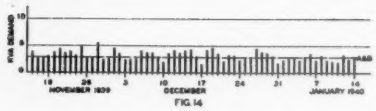

FIG. 14

FIG. 15

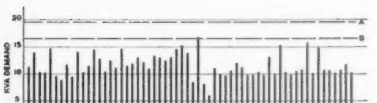

FIG. 16

FIG. 17

FIG. 18

FIG. 19

FIG. 20

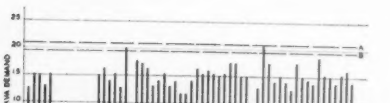

FIG. 21

FIG. 22

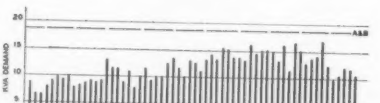

FIG. 23

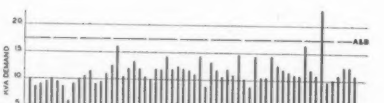

FIG. 24

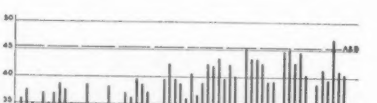

FIG. 25

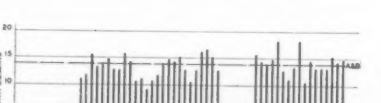

FIG. 26

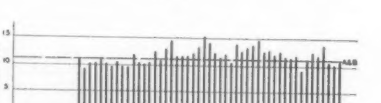

FIG. 27

FIG. 28

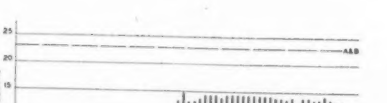

FIG. 29

FIG. 30

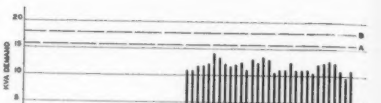

FIG. 31

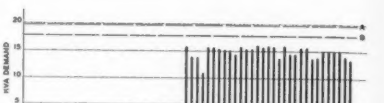

FIG. 32

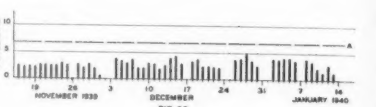

FIG. 33

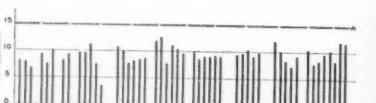

FIG. 34

FIG. 35

FIG. 36

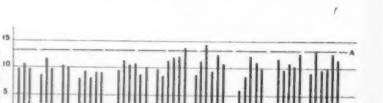

FIG. 37

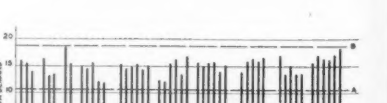

FIG. 38

A Lines Estimated Demand—Number of Ranges Determined from Survey
B Lines Estimated Demand—Number of Ranges Determined from Kwhr Consumption
Figs. 14-38, RESIDENTIAL DISTRIBUTION TRANSFORMER LOAD TESTS

ally low demands should not be included in obtaining these average curves. The percentages indicated for each hour by such a load curve would represent the hourly variation factor or that portion of the maximum demand which might reasonably be expected at any particular hour.

Estimating Transformer Loads

The mechanics of estimating the maximum loads on residential distribution transformers by this "diversified demand" method is quite simple, provided the essential customer data are available. These data, which can often be obtained from distribution secondary records, consist of the total number of customers served from each transformer, together with the number of ranges, refrigerators, and water heaters. The occasional small commercial customer served from a residential distribution transformer usually can be assumed to be the equivalent of a range customer. In so far as refrigerators are concerned, no precise record is necessary, since their percentage of saturation can be assumed with sufficient accuracy. If no accurate data are available as to the number of ranges, their equivalent number can be ascertained by checking the kilowatthour consumption for each three-wire service connected to the transformer for the month of December or January, and assuming a range to be installed where this consumption equals 150 kwhr or more. A kilowatthour method could also be used to determine water heater locations.

The procedure to be followed in estimating residential distribution transformer demands can best be explained by means of examples.

Example No. 1—Assume a transformer serving forty residential customers having a 50 per cent refrigeration saturation but having no ranges or water heaters. Past experience and an examination of the hourly demand variation factors for lighting and refrigerators indicate that both of these loads would peak between 7:00 and 8:00 pm. Therefore we can add these demands directly without giving further consideration to the hourly demand variation factors. Referring to Fig. A, the average maximum demand per customer for forty lighting customers is 0.22 kva and the average maximum demand per refrigerator for twenty refrigerators is 0.09 kva. The probable maximum demand on this transformer would be:

40 x 0.22 kva plus 20 x 0.09 kva = 10.6 kva

Example No. 2—Assume a transformer which serves one commercial customer and twenty-nine residential customers having a 50 per cent refrigerator saturation and ten ranges. Since the commercial customer can usually be assumed to be the equivalent of a range customer, there would be a total of thirty customers, fifteen refrigerators and eleven equivalent ranges. Again past experience and an examination of the hourly demand variation factors for lighting, refrigerators, and ranges indicate that the peak load for this transformer should occur about 5:45 pm. Referring to Fig. A and Table I, we can determine the maximum load on this transformer in the following manner:

	Number of Customers or Units		*Demand per Customer or Unit (Kva)*		*Hourly Demand Variation Factor for 5:45 P.M.*	
Lighting & Misc.	30	x	0.23	x	0.90	= 6.2 kva
Refrigerators	15	x	0.096	x	0.91	= 1.3 kva
Ranges	11	x	1.32	x	1.00	=14.5 kva
Estimated Maximum Transformer Demand						22.0 kva

Tests to Determine Accuracy of "Diversified Demand" Method

During the past few years numerous checks and tests have been made to compare the maximum demands as estimated by this method with reliable test data. These comparisons have involved various numbers of customers up to approximately 500, and with comparatively few exceptions, the estimated demands checked closely with the actual maximum demands.

The question arose as to whether these maximum demands represented a single annual peak or a recurrent peak. Obviously it would be uneconomical to design transformer-secondary combinations for anything but recurrent peaks. To settle this question, arrangements were made in the fall of 1939 to make several tests covering the period of November 15, 1939, to January 15, 1940, as the peak demands usually occur within this period. These tests were conducted on thirty-eight transformers in four north-central states including eleven different cities or towns. Instructions were sent out (and followed in most cases) to use graphic ammeters on transformers serving two or three ranges and either graphic ammeters or fifteen-minute thermal demand ammeters on transformers serving lighting loads only or lighting together with several ranges. The maximum demands taken from the graphic ammeter charts were mean values for periods of five minutes or more. The customer data were obtained from field surveys.

During the course of these tests, the Consumers Power Company compared the actual demands on four of these transformers, which they were testing, with the estimated demands based upon the customer data which they had obtained from field surveys. Not being satisfied with these comparisons, they decided to verify their customer data in regard to the number of ranges served from these four transformers. Their past experience had indicated that a range could be expected on a three-wire service if the monthly consumption during the winter months was equal to or greater than 150 kwhr for a low grade residence, 200 kwhr for a medium grade residence, and 250 kwhr for a high grade residence. With this in mind, they obtained the December consumption for each customer having a three-wire service connected to the transformers under test and then made another canvass of these three-wire services. It was found that some of the customers had not given the correct data in regard to ranges on the first survey. After obtaining the corrected customer data for these four transformers, the estimated demands compared very closely with the actual demands as can be seen by comparing the estimated demands (lines "A" in Figs. 3 to 6, inclusive) with the actual demands.

All operating companies were then requested to send in the kilowatthour consumption for each three-wire service connected to the transformers under test for either the month of December or January or both. After studying these data it was decided to check the original customer data by considering any three-wire customer having a consumption of 150 kwhr or more during December or January as the equivalent of a range customer.

Table II, "Customer Data," gives all of the pertinent data in connection with these transformers which were tested, and Figs. 1 to 38, inclusive, show a graphical comparison between the actual maximum demands and the estimated demands. The vertical lines in Figs. 1 to 38, inclusive, represent the maximum demands for each day, while the horizontal

(*Continued on page* 496)

Impulse Tests on Various Kinds of 4800- and 24,000-Volt Cable

By G. B. McCabe

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Presented before the Transmission and Distribution Committee, E.E.I., Atlanta, Ga., Oct. 14, 1940.

IMPULSE TESTING is fast becoming one of the most useful tools in our industry in proving the capability of a piece of electrical equipment to fulfill satisfactorily its function.

While a considerable amount of surge strength data has been accumulated on various types of station and line equipment, there has been a dearth of like data on cables and their joints and terminals. However, with the increasing number of impulse tests being conducted on cable and its auxiliaries, sufficient data will, it is hoped, soon be available to fill the present gaps in the engineering knowledge needed in the design of system insulation levels and lightning protection equipment.

Surge testing of cable not only subjects the cable sample to conditions simulating lightning during service, but also is quite thorough in searching out faulty construction and nonuniformity and in proving the merits of changes in cable design and materials. Accordingly, The Detroit Edison Company is placing more and more reliance upon such testing for the determination of the acceptability of a type or kind of cable, joint, or terminal for a given service.

On May 4, 1938, the author presented before the Transmission and Distribution Committee of the Edison Electric Institute at Chicago a paper covering impulse tests on 24,000-volt cables from which many interesting observations and conclusions were made regarding the effect of uniformity and degree of impregnation, type of impregnating compound, registrations, and reduced insulation thickness upon surge strength, the location and nature of the failures, and the effectiveness of test terminal design.

Since then, The Detroit Edison Company has conducted numerous impulse tests on a variety of cables in voltage classes from 4800 volts to 132,000 volts. The results of the tests on the extra high-voltage cables will be given by a fellow-employee in a paper to be presented shortly before the A.I.E.E.

The present paper is concerned principally with the following questions:

1. Is the surge strength of 4800-volt paper and lead cables as high as that of the terminating potheads?
2. What effect has migration of impregnating oil in 4800-volt paper and lead riser cables upon surge strength?
3. Are the recently adopted varnished-cambric insulated 4800-volt riser cables as strong as the terminating potheads and as the paper and lead cables which they supersede?
4. What is the surge strength of rubber and lead 7500-volt street lighting cable which is occasionally employed as underground primary mains connecting to 4800-volt overhead circuits?
5. Is it feasible to still further reduce the thickness of the belt insulation of our 4800-volt, 3-conductor, paper and lead cables, which are now insulated with the stipulated AEIC thickness for this voltage, viz., 6/64 in. on the conductor and 4/64 in. on the belt?
6. Would shielded-type cables be satisfactory on the ungrounded delta-connected, 4800-volt system?
7. How is surge strength improved by shielding the conductor of 24,000-volt, 3-conductor, Type-H, paper and lead cables?

The following impulse tests were conducted in order to ascertain the answers to these questions.

Test Method and Equipment

The regular nine hundred thousand-volt impulse generator equipment at Frisbie Substation was used to test the concerned cable samples and the cathode-ray oscillograph employed to determine the breakdown values of the various samples. Excepting for a .40 per cent increase in the inductance and the elimination of the 175-ohm resistance, the circuit arrangement was the same as that shown in Plate 1 in the May, 1938, E.E.I. paper.

As in the previous tests, there was imposed upon the test specimens of cable a negative 1 x 20 wave (that is, one microsecond to crest voltage and twenty microseconds to decrease to one-half crest voltage).

Because of the importance of knowing the maximum value of lightning voltage that the cables can withstand, the Detroit Edison tests on cables have, as a rule, been conducted on a one-shot basis, i.e., a potential greater than the expected breakdown value is applied, thus producing failure before attaining crest voltage. It is known that differences of opinion exist between investigators on the question of impulse fatigue, some feeling that a multitude of repeated shots of surge voltage at a value just under that of breakdown causes no damage to the cable insulation and others feeling the opposite.

Besides the principal reason cited above, viz., that of knowing definitely the maximum strength of the cable insulation in resisting lightning, it appears the one-shot test is justified because of the nonagreement among authorities as to the damaging effect of repeated shots, and of the fact that among those laboratories applying surge voltages in increasing steps to failure there seems to be no standardized procedure, some starting at 50 per cent and others at 60, 70, and even higher percentages of the expected breakdown voltage and some increasing the voltage in small increments and others in large.

Test Specimens

Excepting the two rubber and lead samples, which were from No. 6 and No. 8 single solid-conductor cables, all of the 4800-volt cable specimens were of the 3-stranded conductor belted type. The 24,000-volt samples were of Type-H construction. Tables I, II, III and IV supply further detail regarding the various samples.

Samples of the new unused cables of assorted sizes and makes were readily obtainable from stock. However, it was more difficult to procure used samples to meet our requirements, for the test samples must, of necessity, be chosen from those cables passing through the cable reclamation plant.

4800-Volt Paper and Lead Cables.

Eleven samples of 4800-volt, 3-conductor, paper and lead cables were

tested, seven being from new and four from used cables.

The seven new specimens, all of which had the 6 x 4/64-in. insulation adopted in early 1938, were comprised of four makes and of sizes No. 2 A.W.G. standard round, 200M-cir mil compack sector, and 450M-cir mil compack sector.

The four used specimens, two of which had the 7 x 7/64-in. insulation adopted in 1929 and two the 10 x 10/64-in. insulation employed prior thereto, were all 450M-cir mil sector and produced by three manufacturers.

Two of the eleven samples were of the so-called non-migrating type, being impregnated with an 80-per cent petrolatum, 20 per cent rosin compound. One sample was unused, while the other had experienced one and one-half years' service, not in a vertical position, however.

4800-Volt Varnished-Cambric and Lead Cables.

Three samples of unused 4800-volt, 3-round conductor, varnished-cambric and lead cables were tested, one sample, made by one manfacturer, being a No. 2 A.W.G. size insulated with our present standard 7 x 5/64-in. insulation, and the other two, made by another manufacturer, being 450M-cir mil size slightly over-insulated with 8 x 6/64-in. insulation because of the important use of the cable for carrying the output of a generator in one of the principal generating stations.

7500-Volt Rubber and Lead Cables.

Two samples of 7500-volt street circuit 16/64-in. rubber and lead cables were tested, one being a used No. 6 solid-conductor cable, insulated with a 30-per cent rubber compound and made probably prior to 1925, the other being a new No. 8 solid-conductor cable, insulated with a performance-type rubber compound.

24,000-Volt Paper and Lead Cables.

Three samples of 24,000-volt, 3-350M-cir mil compack-sector-conductor, Type-H, paper and lead cable, produced by one manufacturer, were tested.

One of the samples was of the standard construction with 18/64-in. (281 mils) insulation on each conductor. The other two samples were of shielded-conductor construction, in which three 5-mil conducting tapes were applied next to each conductor, a fourth was applied over the outside of the conductor-impregnated-paper insulation, and a fifth was intercalated with the copper shielding tape. Since the overall diameter of each insulated conductor of this construction is the same as that of standard construction, the effective insulation thickness is reduced by the thicknesses of four 5-mil conducting tapes, and becomes, accordingly, 261 mils.

Preparation of Test Specimens.

The test specimens were made up so as to allow, on the average, an effective test length of ten feet under the lead sheath.

The ends of the specimens were, in general, prepared in a manner similar to that described in the May, 1938, E.E.I. paper. This method, which applies particularly to the 24,000-volt, Type-H cables, consist of the application of a hand-applied cone of varnished-cambric tape insulation over the factory insulation at the end of the shielding tape on each conductor and the installation of small copper cones tied in electrically to the shielding tapes on each of the three conductors at the upper (generator) end of the sample. A truncated cone was fastened, in turn, to the small cones, already installed, as each conductor was tested. The whole cone assembly was immersed in a Micarta tub of transil oil mounted on double crossarms on a stub pole.

The lower end of these 24,000-volt samples was made up somewhat differently from our past practice in that a single large copper cone was wiped to the end of the lead sheath after the standard varnished-cambric and copper cones, formerly employed in shielded-type joints, had been installed on the individual conductors well down in the crotch. After fitting porcelain test cap tubes to the ends of the three conductors, the lower end assembly was immersed in oil in the large tank at the same time the upper end was placed on the crossarms on the stub pole.

The above terminal construction was satisfactory for the surge tests on the all-standard paper cable, but was inadequate for the shielded-conductor-type cable, the first sample of which flashed over at the upper ends of the first and third conductors and failed just beyond the shielding tape on the bottom end of the second conductor. As no failure occurred within the cable, the test results on this sample are not recorded. This made it necessary to prepare a second shielded-conductor sample with terminals constructed to withstand higher potentials. These stronger terminals were made up as follows: A lead trifurcating body, from which emanated three lead tubes, was slipped down over the three conductors and wiped to the cable lead sheath on each end of the test specimen. Each body was filled with 70-30 Vinsol compound so that transil oil in one of the lead tubes emanating from the body could not run through the trifurcating piece into either of the other two lead tubes or into the cable. It was then only necessary to mount the two single-conductor Micarta test terminals, employed to test extra high-voltage cable, on one conductor at a time and fill them with transil oil. Impulse voltage was applied to this first conductor, after which the test potheads were reassembled on the second and third conductors in turn.

Both terminals of the 3-conductor, 4800-volt, belted samples were made up with large copper cones similar to the lower ends of the first two 24,000-volt samples, but instead of applying additional insulation on each conductor, a reinforcing cone of varnished-cambric tape about six inches long was applied over the belt insulation at the end of the lead sheath. The three conductors were fanned out just beyond this cone. The ends were then assembled and mounted as before with the oil-filled Micarta tub on the upper end and the steel tank on the lower.

In the makeup of the ends of the single-conductor, rubber and lead specimens, the large Micarta tub was dispensed with at the upper end, the large copper cone which was sweated to the sheath serving both as a stress control cone and a container for the oil. Hand-applied rubber reinforcement was installed around the factory insulation at the end of the sheath.

Test Results

Tables I, II, III and IV contain all the test results.

The values used in obtaining average breakdown potentials (indicated by asterisks in the tables) were picked largely on the basis of the relative location of the faults to each other. The first shot was always considered good because the initial puncture of the belt insulation occurred then. The second and third shots, if they were to be considered, usually had to be located away from the first one as the failure and burning of the belt insulation near the

Table I—Test Results on 4800-Volt, 3-Conductor, Paper and Lead Cable

Sample No.	Cond. Size and Shape	Mfr. and Year	Insul. Thick. Inches	Breakdown Voltage in Kilovolts			Average Stress in Volts per Mil			Distance of Fault from Upper End of Lead Sheath Inches			Period of Service Years
				Cond. 1	Cond. 2	Cond. 3	Cond. 1	Cond. 2	Cond. 3	Cond. 1	Cond. 2	Cond. 3	
1	No. 2 Rd.	D1939	6 x 4/64	213*	165	190	1362*	1055	1215	7¾	9¼	9	New
	Breakdown Value = 213 kv. Average Stress = 1362 V/mil.												
2	200 M. Sec.	B1938	6 x 4/64	165*	110	140	1055*	704	895	67	66	63	New
3	200 M. Sec.	B1938	6 x 4/64	270*	135	155*	1727*	864	991*	109½	109½	0 & 83	New
4	200 M. Sec.	F1938	6 x 4/64	288*	190	205*	1841*	1215	1311*	0 & 104	104	79	New
	Average Breakdown of 5 Conductors indicated = 217 kv. Average Stress = 1385 V/mil.												
5	450 M. Sec.	F1939	6 x 4/64	212*	180	230	1356*	1151	1471	½	0	2¼	New
6	450 M. Sec.	B1939	6 x 4/64	245*	185	185	1567*	1183	1183	17	17	17	New
	Average Breakdown of 2 Conductors indicated = 228 kv. Average Stress = 1461 V/mil.												
7	450 M. Sec.	E1939	6 x 4/64 N.M.	140*	138*	105	896*	883*	672	2 & 111¼	111½	110¾	New
	Average Breakdown of 2 Conductors indicated = 139 kv. Average Stress = 890 V/mil.												
8	450 M. Sec.	E1937	7 x 7/64 N.M.	225*	125	105	1028*	571	479	8	4½	8	1½
	Breakdown Value = 225 kv. Average Stress = 1028 V/mil.												
9	450 M. Sec.	A1930	7 x 7/64	150*	118	95	685*	539	434	109½	108½	109½	9¼
10	450 M. Sec.	B1929	10 x 10/64	235*	135	130	751*	431	416	111 & 115	117½	112½	7½
11	450 M. Sec.	B1927	10 x 10/64	145*	120	115	464*	384	368	114½	114½	115½	12¼
	Average Stress of 3 Conductors = 633 V/mil.												

* These values were used in obtaining average breakdown voltage and average stress.
N.M. = So-called Non-migrating Impregnant.

Table II—Test Results on 4800-Volt, 3-Conductor, Varnished-Cambric and Lead Cable

Sample No.	Cond. Size and Shape	Mfr. and Year	Insul. Thick. Inches	Breakdown Voltage in Kilovolts			Average Stress in Volts per Mil			Distance of Fault from Upper End of Lead Sheath Inches			Period of Service Years
				Cond. 1	Cond. 2	Cond. 3	Cond. 1	Cond. 2	Cond. 3	Cond. 1	Cond. 2	Cond. 3	
12	No. 2 Rd.	F1939	7 x 5/64	188*	160*	160*	1002*	854*	854*	114	61½	53½	New
	Average Breakdown of 3 Conductors indicated = 169 kv. Average Stress = 903 V/mil.												
13	450 M. Rd.	E1939	8 x 6/64	No Record	130	215*	....	593	982*	27	28	29	New
14	450 M. Rd.	E1939	8 x 6/64	195*	160	160*	890*	731	731*	88	88	47	New
	Average Breakdown of 3 Conductors indicated = 190 kv. Average Stress = 868 V/mil.												

Table III—Test Results on 7500-Volt, Single-Conductor, Rubber and Lead Cable

15	No. 8 Sol. Rd.	F1937	16/64	75*	....	....	300*	....	....	6½	....	....	New
16	No. 6 Sol. Rd.	Unknown	16/64	80*	....	....	320*	....	....	5½	....	....	15+

Table IV—Test Results on 24,000-Volt, 3-Conductor, Standard-Shielded and Shielded-Conductor Cables

Sample No.	Cond. Size and Shape	Mfr. and Year	Insul. Thick Mils	Breakdown Voltage in Kilovolts			Average Stress in Volts per Mil			Distance of Fault from Upper End of Sh. Tape Inches			Period of Service Years
				Cond. 1	Cond. 2	Cond. 3	Cond. 1	Cond. 2	Cond. 3	Cond. 1	Cond. 2	Cond. 3	
17 Std.	350 M. Sec.	1940	281	400*	390*	380*	1425*	1390*	1350*	22	105	6	New
	Average Breakdown of 3 Conductors = 390 kv. Average Stress = 1390 V/mil.												
18 Sh. Cond.	350 M. Sec.	1940	261	500*	485*	480*	1915*	1860*	1840*	34	16	116	New
	Average Breakdown of 3 Conductors = 488 kv. Average Stress = 1870 V/mil.												

* These values were used in obtaining average breakdown voltage and average stress.

first fault would make a second or third fault near it of comparatively low value.

All 4800-volt and 7500-volt failures occurred under the lead sheath except in the case of three conductors. In two of these cases, each conductor had a double failure, one failure being at the end of the sheath and the other well under the sheath. In the third case, the only failure was found at the end of the sheath.

The six failures on the 24,000-volt cables all took place under the sheaths or copper-shielding tapes.

Although it is well known that insulation thickness and contour of the conductor, i.e., size, shape, stranding, etc., have a strong influence on the maximum surge gradient, no account was taken of such variables in these tests, the tables being set up on an average stress basis. The principal reason for this is the difficulty in calculating the maximum stress at the surface of a compack conductor.

The results of the tests are analyzed and discussed in the following in an endeavor to obtain answers to the seven questions outlined in the introductory paragraphs of this paper.

Comparative Surge Strengths of 4800-Volt Paper and Lead Cables and Terminating Potheads.

Previous to the present tests, some impulse tests had been conducted on the three-conductor horizontal pole-type potheads employed for terminating the 4800-volt, 3-conductor riser cables. It was found that the old style Detroit Edison horizontal cast-iron pothead had a surge strength of 143 kv, while the newer type designed by us and first built in 1937 by a pothead manufacturer had a strength of 155 kv.

It was, of course, desired that the riser cables be at least as strong as the terminating potheads. It will be noted in Table I that the tests on Samples 1 to 6 revealed average surge strengths of 213 kv for No. 2, 3-conductor, 6 x 4/64-in., paper and lead cables impregnated with the usual saturants, of 217 kv for the 200M-cir mil, and of 228 kv for the 450M-cir mil sizes, values well above the surge strength of the pothead. It should be pointed out, however, that the surge strength of the weakest conductor was only 155 kv, just equal to that of the present pothead. Since the oils with which cables are normally impregnated have a tendency to migrate in vertical runs, the effect of such migration over a period of years upon the surge strength of riser cables was determined.

Effect of Migration of Impregnating Oil in 4800-Volt Paper and Lead Riser Cables Upon Surge Strength.

Samples 9, 10, and 11 of Table I were removed from pole-riser cables which had been in service from 7½ to over 12 years. Accordingly, they were, in general, fairly devoid of impregnating oil, which, in Sample 9, was a mineral oil-rosin compound, and in Samples 10 and 11 mineral-oil petrolatum.

It will be noted that the average stress upon impulse breakdown for the three cables was but 633 volts per mil. On the basis of the present standard insulation wall of 10/64 in., i.e., 6/64 in. on the conductor and 4/64 in. on the belt, a cable with such surge strength would break down at 99 kv, which is only about two-thirds the strength of the connecting potheads.

Quite striking, also, is the apparent deterioration due to migration revealed in the tests on Samples 10 and 11, in which the average stress at breakdown dropped from 751 volts per mil after 7½ years' service to but 464 volts per mil after 12¼ years' service. On a modern 6 x 4/64-in., insulated cable, the latter value would be equivalent to a surge strength of only 72 kv, barely half the strength of the potheads.

It appears quite inadvisable, therefore, to employ cable impregnated with the usual saturants in vertical runs.

A check test on two samples, i.e., Nos. 7 and 8, of so-called non-migrating cable impregnated with 80 per cent petrolatum and 20 per cent rosin, disclosed that, in the case of Sample 7 with the present 6 x 4/64-in. wall of insulation, the surge strength of 139 kv is just under the minimum pothead strength of 143 kv. Sample 8 with the former 7 x 7/64-in. thickness, however, with a value of 225 kv, is well above the pothead strength.

As was pointed out in a paper by the author before the E.E.I. Underground Methods and Accessories Subcommittee on October 9, 1939, at Swampscott, the non-migrating characteristic of these so-called non-migrating cables have definite limitations when the cables are subjected to both a hot sun and a heavy load, and accordingly, high-temperature, varnished-cambric cables were adopted for all vertical runs on the 4800-volt cable system.

Surge Strength of Varnished-Cambric Insulated Cables.

It will be noted in Table II that Sample 12, which has a 7 x 5/64-in. wall of varnished cambric, has an average surge strength of 169 kv, while Samples 13 and 14 with an 8 x 6/64-in. wall has a strength of 190 kv, both values being satisfactorily greater than the corresponding values for the potheads.

While the average stress at breakdown for these varnished-cambric insulated cables is but 900 volts per mil, compared with over 1400 volts per mil for new impregnated-paper cables, it is felt that due to the absence of oil in the varnished-cambric-insulated cables, they have a more stable and permanent insulation than impregnated-paper-insulated cables when employed in vertical runs. Accordingly, over a period of years in service, they should suffer but little change in surge strength compared to paper insulated cables, which according to the results on Samples 9 to 11, experienced a drastic drop.

Surge Strength of 7500-Volt Rubber and Lead Street Circuit Cable.

Table III shows that there is little difference in the surge strengths of modern Sample 15, which is insulated with 16/64-in. performance-type rubber and of old used Sample 16, which is insulated with the same thickness of 30 per cent rubber, both having an average stress at breakdown of about 300 volts per mil, a value considerably below those for varnished-cambric and paper-insulated cables. The resistance to lightning of such rubber-insulated cables should, therefore, be comparatively poor.

Feasibility of Reducing the Belt Insulation of 4800-Volt Belted Paper and Lead Cables.

Feasibility of Employing Shielded Cables on a 4800-Volt Ungrounded System.

The surge strength aspects of both a further reduction in the belt insulation of 4800-volt, belted-type, paper and lead cables and the adoption of shielded (Type H) cables on the 4800-volt system can be considered simultaneously.

In Table I, it will be noted in the case of Samples 2 and 3 that the average stress at breakdown, even in a modern cable, may be as low as 1000 volts per mil or less. After a period of service, a further decrease could nor-

mally be expected. A cable with but 9/64-in. wall, i.e., 6/64 in. on the conductor and only 3/64 in. on the belt, constructed like Sample 3, say, would when new have a surge strength of less than 140 kv and might with time and deterioration have a strength even less than 100 kv.

A comparable shielded-type cable for 4800-volt service would have an insulation thickness of 7/64 in. and, at 991 volts per mil, a surge strength of only 108 kv. A shielded-type cable, therefore, would not be satisfactory from a lightning resistance standpoint. Moreover, such type cable, despite less material required, costs more at present quoted prices than belted.

Effect of Conductor Shielding on Surge Strength.

Reference to the test results on Samples 17 and 18 in Table IV indicates that conductor shielding decidedly improves the surge strength of three-compack - stranded - conductor, 24,000-volt, Type-H, paper and lead cables, the average stress of 1390 volts per mil for the cable of standard construction being increased to 1870 volts per mil for the shielded-conductor construction, a gain in average impulse stress of almost 35 per cent. An improvement of this order was anticipated, for the conductor-shielding tapes tend to eliminate the effect of the individual strands and to give the conductor more nearly the surface characteristics of a smooth copper rod with consequent high-impulse breakdown values.

As described before, the sample with conductor shielding had but 261 mils of effective insulation compared with 281 mils on the sample with standard construction. Thus, despite a 7 per cent reduction in effective thickness of insulation the shielded-conductor construction increased the surge strength of the cable from 390 kv to 488 kv, an improvement of over 25 per cent. This suggests a further proportionate decrease in insulation thickness on cables with such conductor shielding, with consequent savings to the industry.

Hope had been entertained to include in this paper also the results of impulse tests on another make of cable, in which certain modifications were made in the conductor shielding, in order to determine if a similar improvement in surge strength were to be derived from such construction. Unfortunately, the shipment of this type cable did not reach Detroit until about four days before this meeting, and therefore too late to prepare and test the samples.

Summary

1. Surge strength of the old style Detroit Edison horizontal pole-type potheads is 143 kv and of the new style manufactured pothead 155 kv.

2. Surge strength of modern 4800-volt, 6 x 4/64-in., paper and lead, belted cable varies from 155 kv to 288 kv, the strength of the poorest specimen being just equal to that of the present pole pothead.

3. Average impulse stress in volts per mil for new 4800-volt, paper and lead, belted cables is over double that for similar type cables that have operated from 7 to 12 years in vertical runs. Such decrease in strength is an argument against the employment in vertical runs of cables impregnated with the usual saturants.

4. Surge strength of a 4800-volt, 6 x 4/64-in., paper and lead, belted cable impregnated with a so-called non-migrating compound of 80 per cent petrolatum and 20 per cent rosin is slightly less than that of the old style pothead. Limitations set up by hot sun and heavy loads have made it advisable to supersede such riser cable with the recently adopted high-temperature varnished-cambric insulated and lead-belted cable.

5. Surge strength of the standard 4800-volt, 7 x 5/64-in., varnished-cambric and lead-belted cable is better than that of the present pothead. Due to the absence of oil, the insulation is probably more stable and more likely to suffer but little change in surge strength compared with oil-impregnated paper when used in vertical runs.

6. Impulse strength of both the old 30 per cent and new performance-type rubber-insulated cables is only about 300 volts per mil. This indicates the inadvisability of any extensive use of such cables for connections to overhead 4800-volt lines.

7. In view of the weakest modern cable having a surge strength just equal to that of our present pothead (see preceding Item 1), it is inadvisable either to reduce the belt insulation or to employ shielded construction, which requires only 7/64-in. wall for 4800 volts.

8. Conductor shielding on 24,000-volt, Type-H, cables resulted in a 24 per cent improvement in surge strength despite a 7 per cent decrease in effective thickness of insulation. This suggests that considerable savings to the industry might be effected by a further proportionate decrease in insulation thickness on cables with conductor shielding.

New Standard Distribution Transformers

AT a meeting of the E.E.I.-NEMA Joint Committee on Standards for Distribution Transformers held in Jackson, Michigan, Sept. 19 and 20, much time was given to preparation of recommendations for low-voltage connectors looking toward elimination, simplification and reduction of cost as among the large variety of connectors at present being supplied. Mounting arrangements for transformers rated 75 and 100 kva also were studied, together with a series of tests of mountings in the medium sizes. These mounting tests provided further proof of the adequacy of Support Lugs and the T-Crossarm Hangers.

At the meeting of E.E.I. Transmission and Distribution Committee, in Atlanta, October 14-16, a progress report outlined the present status of the Joint Committee's work, also at a subject session, members of the Joint Committee discussed detail features with interested engineers. Much of this centered around the subject of pole mounting as compared to crossarm mounting. There was recognition of the growing influence of rural line construction upon urban line design with an increasing tendency to use direct pole mounting of transformers for its advantages of simplicity, cost reduction, and improved appearance.

It also was brought out at Atlanta that new standard transformers corresponding to the recommendations of the Joint Committee's First Report are becoming increasingly available during the fall months, and that substantial numbers already have been delivered. Operators were advised to keep in contact with their regular suppliers so that early purchases may be made of the new standard units in order to gain experience for needed revision of construction drawings and the familiarizing of line crews. Manufacturers give assurance of general availability in January, 1941, at which time, they announce the new transformers will be cataloged and revised price schedules become effective.

McGraw Prize Paper

The Planned Operation of a Reservoir System

By Vincent Thiemann

THERE ARE MANY perplexing problems in operating a system of water reservoirs, since it is not possible to foretell what the river flow conditions will be for the ensuing twelve or even six months, and what would be good judgment for one season turns out to be rash guessing in another. Despite these difficulties it is necessary for operators of reservoirs to essay the attempt to formulate a scheme of reservoir operation so that the probabilities are on our side rather than against us; it is better to have some plan, even incomplete, by which to chart our course, than to steer blindly guided only by the weather and the sentiment of the moment.

There is always the temptation to use the storage water too early in the season, on the basis that we can at least benefit by the kilowatthours for the present, and we'll trust to later rains to replenish the storage before the dry winter months; this course, however, is hazardous, for a protracted drought will find the reservoirs depleted too soon and they will be unable to sustain the firm hydro capacity which they should. On the other hand, if the reservoir storage is conserved miserly there is the likelihood that subsequent flood waters may have to be wasted because the anticipated drought never materializes in four years out of five.

The reservoir operator must steer his course between the Scylla of reduced firm hydro capacity and the Charybdis of lower hydro energy. Several years ago the author worked out a system of operation for the upper reservoirs of the Wisconsin Valley Improvement Company which assures the maximum possible firm river flow, but which also allows the use of the storage as "free" or uncontrolled reservoirs as long as certain conditions are met to insure this firm capacity. This compromise places the emphasis upon the firm river flow; there will be times when storage water which could have been used will be wasted; yet most of the storage will be useful, and I feel that the method described in this paper results in a satisfactory solution of this particular reservoir operation.

Mr. Thiemann is the winner of the Third James H. McGraw Prize for 1940.

Mr. Thiemann is Assistant Chief Engineer in charge of Engineering and Electric Research of the Wisconsin Public Service Corporation, Milwaukee. He is a graduate of the University of Wisconsin, 1925, B.S. in E.E. He started work with the Wisconsin Public Service Corporation in 1927 in charge of the drafting department. Mr. Thiemann received a scholarship from Harvard University in 1928 and obtained his Master's Degree in 1929, when he returned to the Wisconsin company.

His work has consisted of engineering and economic studies on power production, transmission and distribution. These investigations include system planning, reports on the feasibility of proposed generating stations or interconnections, valuations and depreciation studies.

The Wisconsin Valley Improvement Company owns and operates a system of 21 reservoirs, with a total capacity of 16 billion cubic feet of storage, upon the Wisconsin River and its tributaries. These benefit 24 hydro stations which pay tolls for the use of storage water; of these hydro plants, about half are owned by three electric utilities and the remainder belong to paper mills, most of which purchase their excess requirements from these utilities. It is apparent that low river flow means not only a reduction in firm capacity to the electric companies, but an increase in their paper mill load at the same time, and the juxtaposition of these grave consequences required a vital inquiry into the method of reservoir operation to insure maximum firm capacity.

The Big Eau Pleine Reservoir is located at a considerable distance downstream from the rest of the system, so that it presents a separate problem; this article refers to the "upper" reservoir operation, the 20 reservoirs located upstream from Merrill where the gaging station is located which has been used in these computations. These upper reservoirs have an effective storage capacity of 11.3 billion cubic feet, which is 260,000 acre feet or about 130,000 second foot-days. These upper reservoirs are operated to try to maintain a uniform flow past Merrill, which has a drainage area of 2780 square miles, the flow from 1555 square miles of this being regulated by these reservoirs. The average river flow at Merrill is 2600 cubic feet a second, which is 950,000 second foot-days. The average precipitation in the basin above Merrill is slightly over thirty inches a year, and since the above run-off amounts to 12.4 inches annually there is almost a foot and a half of water lost a year from the land and water surfaces. The evaporation from water surfaces such as reservoirs in this basin averages about 30.6 inches a year, which only by coincidence is approximately the amount of the average precipitation.

The first task in determining the firm river flow possible with a system of reservoirs consists in finding the period of minimum river flow. In studying these problems I have found it convenient to use a reservoir year ending March 31, rather than the calendar year or the water year ending Sept. 30 used in the

U.S.G.S. Water Supply Papers, because the reservoirs are usually practically empty at the end of March, and beginning the first of April there is always a surplus of water for replenishing them, even if they cannot always be filled in the Spring. There may or may not be Fall rains, so the complete cycle of reservoir operation runs from March to March. In the 36 years investigated, from 1904 to 1939, the period of greatest sustained deficiency in the Wisconsin River flow at Merrill was June 27, 1933, to March 25, 1934. It is interesting to note that this period did not occur during the lowest reservoir year, that ending March, 1926, and also that the month of minimum river discharge, August, 1934, occurred in neither the lowest reservoir year nor in the period of greatest sustained deficiency in river discharge.

The next step was to determine the natural river flow for this particular season, eliminating the effect of the reservoirs. Each reservoir has been calibrated to determine the quantity of water in storage for each foot of elevation of the water surface so that the gain or loss in storage for any week or month can be found from the changes in levels. If this gain or loss in storage is subtracted from or added to the river flow at the Merrill gage the result is the "apparent" natural river flow. This is called the apparent natural flow because the loss in storage includes not only the useful water released but also the loss due to evaporation and ice; when adjustment has been made for these factors the natural river flow is thereby determined. It is true that a large part of the evaporation would have been experienced anyway, because most of the upper reservoirs are simply natural lakes whose levels are controlled, while there would be almost 2/3 as much evaporation and transpiration from the land where the artificial reservoirs are as from the water surface. However, the adjustment for evaporation is necessary because of the way the reservoir use is determined from the water levels, so that the natural river flow, and not the reservoirs, are credited with the evaporation which amounts to more than 300 c.f.s. in July and August.

Measurements on other river basins near the Wisconsin indicate a minimum flow about 0.2 c.f.s. a square mile, which for Merrill is about 550 c.f.s., which is almost exactly the natural flow. I computed for August, 1934, the minimum month, although the apparent natural flow that month was only 269 c.f.s., and

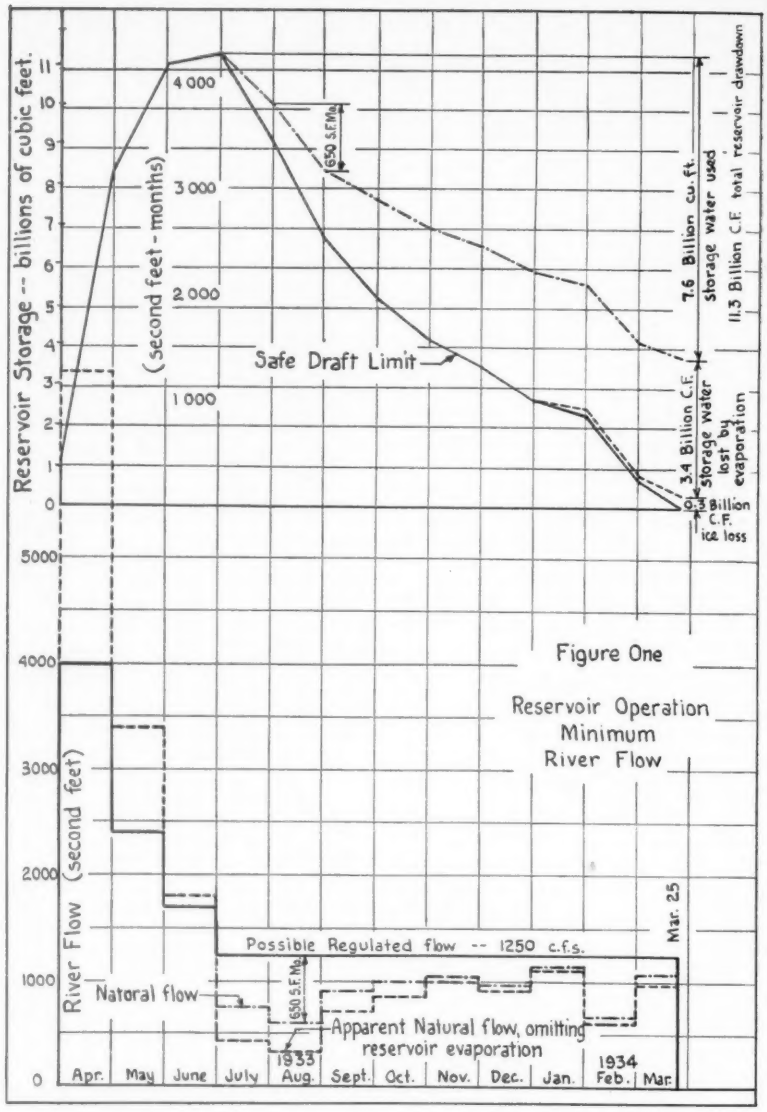


Fig. 1—Reservoir Operation Minimum River Flow

one week the apparent natural flow was zero. This corroborates the adjustments made for evaporation. The ice loss is that due to amount of storage which is left on the sloping sides of the reservoirs as ice when the water is drawn down. This represents a total loss as far as the current reservoir season is concerned, although it remains in storage and helps replenish the reservoirs at the time of the spring run-off.

Figure 1 shows how the reservoirs should have been operated to maintain the maximum firm river flow during the season of greatest deficiency in river flow. The apparent natural flow and the natural river flow were calculated as described above and are shown on the lower part of the sheet. The reservoir state is shown at the top of the sheet plotted to the same scale (one inch equals 1000 second feet for one month) as the river flow graph at the bottom of the page, so that the vertical distance between the reservoir state at the beginning and the end of the month is the same as the vertical distance between the natural flow and the regulated flow, as shown on the diagram for the month of August.

After deducting the evaporation and ice loss from the reservoir capacity we find that the useful storage amounts to 7.6 billion cubic feet, about two-thirds of the effective capacity. This is unusually low because so many of these reservoirs are natural lakes with drafts restricted to a few feet; the newer,

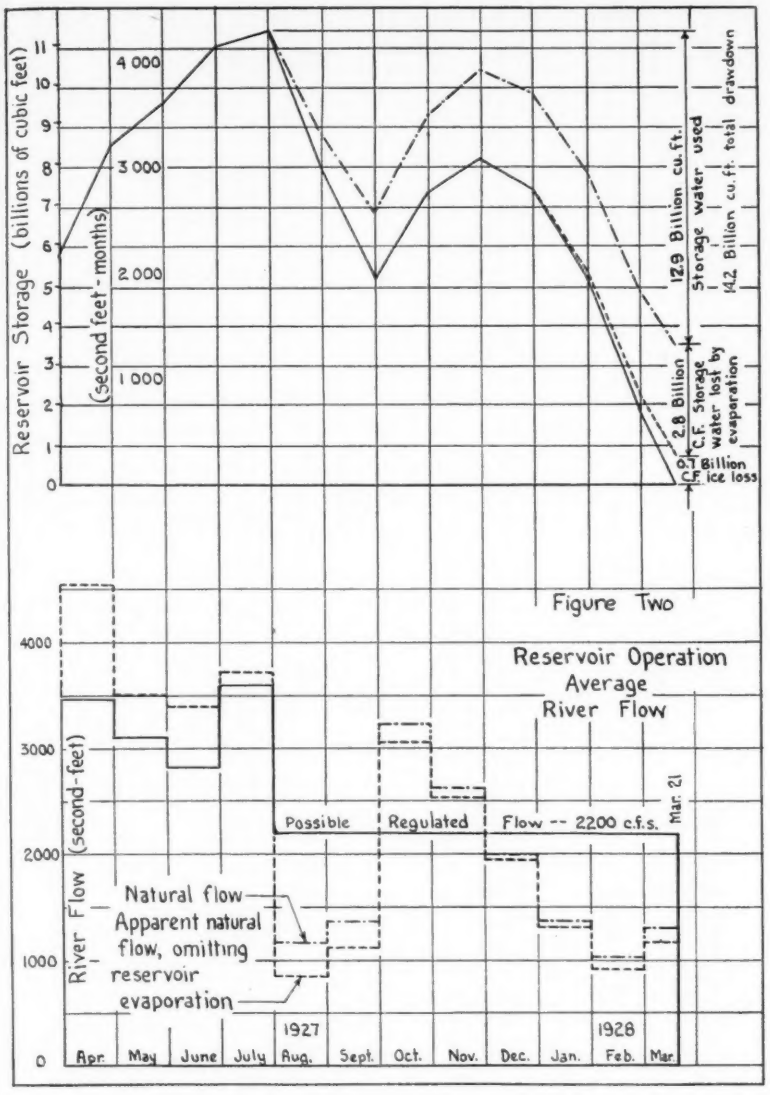


Fig. 2—Reservoir Operation Average River Flow

artificial reservoirs are considerably deeper and hence their losses are much less in proportion to their capacity. This useful storage added to the natural flow indicates the reservoirs could maintain 1250 cubic feet a second at Merrill under the most adverse conditions encountered in the 36 years of record. While still lower periods of low flow are possible, there is evidence that we are now on an ascending portion of the cycle and that it will be a very long period of years before we again experience the low flows of 1930-34.

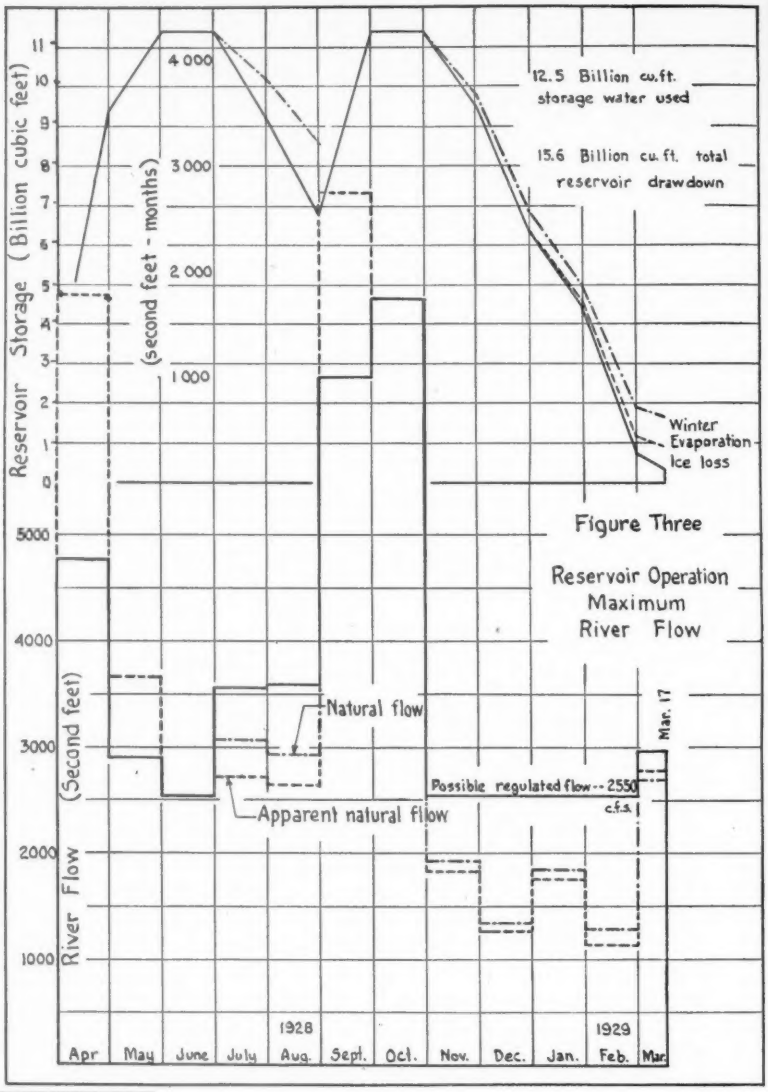
So 1250 c.f.s. is our firm river flow, on which we can depend, and we have computed our system firm capacity on that basis. After my determination of the possible firm river flow was made and submitted to the Wisconsin Valley Improvement Co. as a basis for operating the reservoirs to secure at least that value of river discharge at all times, independent checks were made to establish the correctness of these results by the manager of the reservoir company and also by a consulting engineer employed by that company, and these engineers found values of 1280 c.f.s. and 1300 c.f.s. for the firm flow, or substantially the same value which had been determined, and the differences between the three estimates are due mainly to a different judgment of the effect of evaporation loss.

This calculation for the period of greatest deficiency gives us not only the firm flow which can be maintained, but the curve of reservoir drawdown which is shown in Figure 1 represents the *Safe Draft Limit*. The reservoirs cannot be allowed to be drawn below this line without jeopardizing the firm flow, since it is necessary to have the amount shown in storage at all times in order to insure that 1250 c.f.s. can be supplied, given a repetition of the low stream flow. One more investigation not shown, however, was necessary in order to establish this Safe Draft Limit; that was, it was necessary to see if there was any March with a lower stream flow than March, 1934; or any February and March combined which were below the corresponding period in 1934; likewise for January, February, and March taken together, and so on. Happily, these later months in the reservoir year 1933-34 were the lowest of any, so that no adjustment had to be made to the Safe Draft Limit. If, however, February and March of some other year had been lower in natural river flow, then sufficient water would have to be shown in the reservoirs as of February 1, on this Safe Draft Limit, to allow 1250 c.f.s. to be maintained in such other year. The objection may be raised that this is inconsistent, for then 1250 c.f.s. could not have been secured under conditions like 1933-34 without drawing down the storage below that revised Safe Draft Limit. True, but along with this Draft Limit goes the exception that the reservoirs may be drawn below that limit when necessary to maintain 1250 c.f.s., but not otherwise. It would have been necessary to go below the draft limit in August, 1934, in order to keep the firm flow up to 1250 c.f.s., but these exceptions are necessary to provide this value of firm river discharge under all possible conditions.

Figures 2 and 3 show the possible regulated river flow and the corresponding reservoir states for a year of average river flow (1927-28) and a year of maximum discharge (1928-29). These were calculated in order to see what plan of operation would result in the greatest output of the reservoirs in these typical years. Naturally, the regulation shown is perfect, since these curves have been plotted using hindsight about what actually happened. No reservoir system, of course, could be operated to give the results shown on these figures two and three, yet an examination does disclose some interesting factors which will be helpful in formulating some general principles. We notice that both these years, unlike that having the lowest river discharge, had replenishing seasons in

the fall of the year in addition to the major filling period in the spring. Hence if the entire storage had been retained except that necessary to bring the low flow up to 1250 c.f.s., water would have been wasted later which might have been stored if the reservoirs had been drawn down for it. So it becomes apparent that it is desirable to have some use of reservoir water in the summer, even if the natural flow is fairly good. On Figure 2 the reservoirs have been drawn down to the Safe Draft Limit by Sept. 30; on Figure 3 the Draft Limit is followed exactly during July and August, even though the flow past Merrill is about 3500 c.f.s., because the September and October floods more than fill the reservoirs. But the drawdown in the amounts shown for the summer months for these two years are not conservative, in my opinion, and it would be better to reduce the summer draft on the reservoirs in order to play safe, even if some energy is thereby wasted.

Water released from storage is less valuable at high river stages than at lower flows for two reasons; because the increment fuel cost it replaces is much lower when the hydro stations are carrying a larger proportion of the load and because many stations do not have sufficient turbine capacity to utilize the entire flow. Figure 4 shows the relationship of total head of hydro stations which can utilize the various amounts of river discharge indicated. The hydraulic capacities of each station have been related to the equivalent river discharge at Merrill in proportion as the



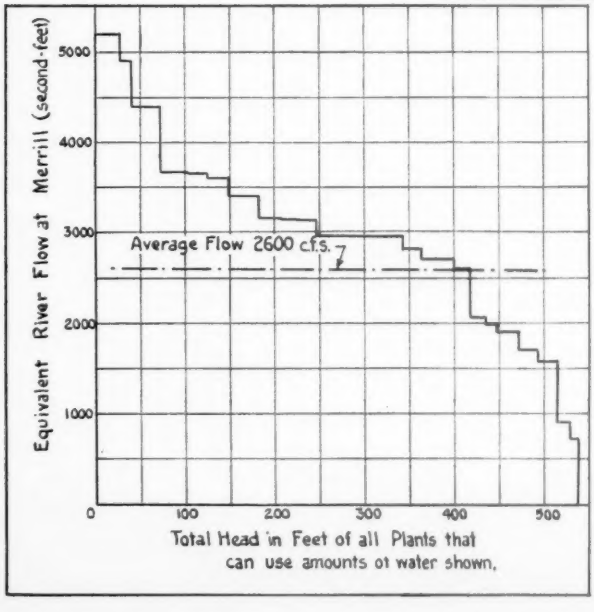


Fig. 3—Above—Reservoir Operation Maximum River Flow

Fig. 4—Left—Relation of Total Plant Heads to Useful River Flow

Merrill drainage area is to the drainage area at the respective stations. Most of the water is usable up to 1500 c.f.s. flow; about three-fourths of the developed head on the river can use the average river flow of 2600 c.f.s. at Merrill, but before a 3000 c.f.s. discharge is reached over half of the hydraulic head in plants is wasting water, and the abnormally high river flow is of very doubtful value to the remainder.

Observation of the behavior of Wisconsin streams leads to the conclusion that in years of extremely low river flow the minimum month is August; when fairly high discharge is experienced the lowest month is February; while for in-between years the low month occurs in September or February with equal frequency. No storage need be carried over from one reservoir year to another since

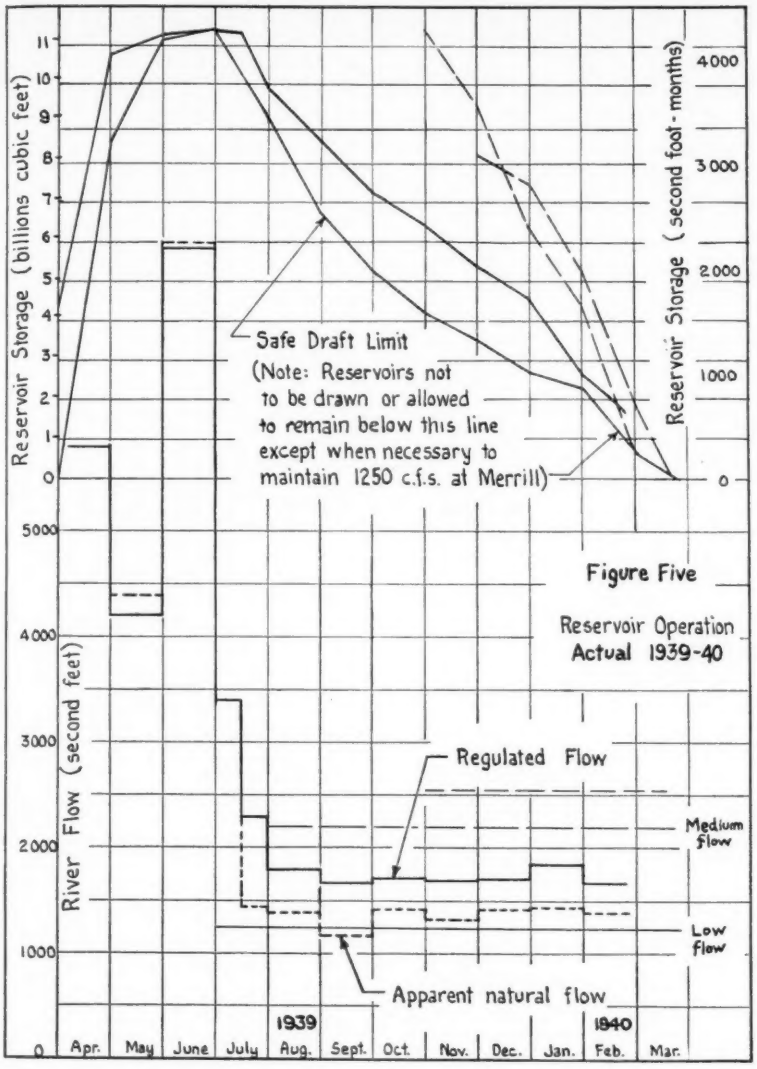


Fig. 5—Reservoir Operation Actual 1939-1940

there is almost always a large enough run-off in April and May to fill the storage; in the years this early spring run-off did not materialize there have been flood flows in June or July to replenish the capacity.

As a guide to the reservoir operation the following suggestions have been formulated. They cover all phases of the annual cycles and are based on probable sequences of events from observation and experience. However these are not hard and fast rules and their application should be flexible and tempered by reasonable judgment:

1. *Firm River Flow.*

A firm river flow of 1250 c.f.s. can and should be maintained at all times and drafts shall be made on the reservoirs to keep the discharge at Merrill at or above that value regardless of the time of the year or the state of the reservoirs.

2. *Safe Draft Limit.*

The reservoirs shall not be drawn below the Safe Draft Limit except when necessary to maintain 1250 s.f. at Merrill, and in such event the draft shall only be sufficient to bring the regulated flow at Merrill up to 1250 s.f.

3. *Seasonal Operation of Reservoirs.*

When the storage exceeds the Safe Draft Limit, the following rules of operation shall be followed:

a. *April, May and June. (Replenishing Period.)*

As soon as the spring run-off begins, which is usually before the end of March, all reservoirs should be closed as much as possible so that the maximum amount of water may be conserved, and no reservoir water should be released during these three months with the aim that the reservoirs shall be 100% full on July 1, unless it may be necessary in June to release water to bring the river flow past Merrill up to 1250 c.f.s.

b. *July and August.*

The storage water should be released in order to give a uniform flow at Merrill whenever the river discharge starts to drop below 2500 c.f.s. after July 1. The weekly release should be as follows:

Flow Past Merrill	Weekly Release of Storage Water
3000 c.f.s.	none
2500 c.f.s.	110 million cu. ft.
2000 c.f.s.	225 million cu. ft.
1500 c.f.s.	350 million cu. ft.

Intermediate values should be found by interpolation in the above table.

c. *September, October and November.*

During these three months an increase in natural river flow is experienced, and ordinarily there is an excess of river flow so that the reservoirs will be filling rather than emptying during at least a part of this period.

As a criterion of reservoir operation it is suggested that during these three months the reservoirs be operated to maintain the same average flow past Merrill as during the preceding July and August. The average regulated flow at Merrill should be computed for July and August (omitting such periods when the flow exceeded 3500 s.f.) each year and when the natural flow during the subsequent three months exceeds this amount the excess shall be retained in storage; when the natural flow is less than the flow was past Merrill during July and August then sufficient water shall be released to maintain the river flow at the July-August average.

d. *December, January, February and March.*

During these four months reservoir water should be released so that a uniform river flow is maintained and that the reservoirs may be emptied by March 31. To accomplish this end the following monthly operation is suggested:

(1) *December and January*

One-fifth of the water in reservoirs at the beginning of each of these months may safely be released during the month, unless the resulting river flow at Merrill exceeds 2500 s.f., in which case there should be only sufficient draft to make 2500 s.f. at Merrill.

(2) *February*

Two-thirds of the water remaining in reservoirs on February 1 should be released during this month.

(3) *March*

The reservoir draft during March should be so as to bring the water in storage down to 3.5% of the total reservoir capacity by March 21, and down to zero capacity by March 31, except that as soon as the spring run-off starts drafts on the reservoirs shall cease, and the reservoirs shall be closed as much as possible in order to conserve the maximum amount of water and completely fill the reservoirs if possible.

The "proof of the pudding is in the eating" and Figure 5 illustrates the operation this past year. Candor compels the admission that this result was secured without benefit of the foregoing suggestions concerning summer operation, but with the calculated firm flow and the Safe Draft Limits as guides, as well as the average and high year operations. The regulated flow was so uniform that this cannot be regarded as a typical result for it is really too good. Next year we may not be as lucky in getting such perfect operation, but we are certain, next year and every year, that we can count on 1250 c.f.s., and this assurance is very important in providing capacity to meet our electrical requirements.

In years of subnormal discharge we are now certain of a more uniform flow without risk to the dependable capacity, which is as great as possible with the present reservoirs. Only in times of abnormally high stream flow will appreciable amounts of useable water be wasted, and then there is very little value attached to the excessive flows. In military parlance the reserve is termed a commander's "peace of mind"; and to the water power operators the firm capacity in storage brings tranquillity in the assurance of adequate reserve against any possible eventuality.

Since 1934 two reservoirs have been added to the system. But had they been operated in the same fashion as the rest of the system in 1933 and 1934 the firm flow at Merrill would only have been about 900 c.f.s. instead of 1250. This increase in firm discharge is almost 40% and results in an estimated 15,000 kilowatts more of firm capacity in all the hydro stations, so that the saving in investment alone effected by this operation is in the neighborhood of two million dollars, which is not an insignificant sum.

Plan Now to Attend the National Accounting Conference at Detroit

Fall Lighting Campaign Builds Load for Middle West Companies

On September 1 the companies of the Middle West system began their Fall Lighting Campaign for 1940: four months of intensive promotion of lighting and lighting appliances by employees of all departments. Based on Better Light-Better Sight principles, the campaign has the double purpose of building electric load and improving the relations of the utilities with electrical dealers and the public.

In two previous campaigns, conducted in 1938 and 1939, these companies achieved an enviable record in sales of bulbs and lamps, both direct and through local dealers. One, the Kentucky Utilities Company, in 1939 sold lamps to 75 per cent of its customers, most of the sales being made through dealers. On the basis of the experience gained in these two drives and the possibilities they see for future promotion of lighting, Middle West executives rank lighting sales as the Number One load builder. They estimate that the 1938 and 1939 activities added $1,000,000 a year to the electric revenues of the system.

Groundwork for the 1940 campaign was laid at four two-day meetings held in July at Chicago, Kansas City, St. Louis and Dallas, central points in the system. At these, key employees from the operating companies were assisted in planning their company campaigns by Middle West executives and representatives of lamp manufacturers and of the Better Light-Better Sight Bureau.

Edwin Vennard, vice-president, Middle West Service Company, emphasized in a talk at each meeting that, excellent as past results had proved, a great market for lighting remained to be sold. He demonstrated this through a series of slides portraying graphically the findings of a survey conducted in 1939 among customers of four typical Middle West companies. Stressing the need for more complete coverage, Mr. Vennard pointed out the conclusions to be drawn from the survey: over half the homes in these typical territories had no spare bulbs; 60 to 70 per cent had empty sockets and, of these homes, about three sockets per home were empty.

He named nine reasons for regarding lighting promotion as the Middle West group's most important new business activity:

1. *Low Capital Investment.* Very little, if any, additional money or equipment is required to serve the new lighting increases. Generally, the volume comes from a great number of small users, therefore, large expenditures are not required.

2. *Customer Relations.* Every customer is a lighting customer with more benefits than from any other service we provide. Customers know what Lighting is—they may not know what it costs—that's our customer-relations job.

3. *Trade Relations.* More retail stores handle bulbs than any other lighting equipment. Promoting Light Conditioning promotes business for those retailers, hence, better trade relations.

4. *High Rate Kilowatt Hours.* Every customer is a lighting customer. Practically all rate structures were designed primarily for lighting, therefore lighting is first and comes at the high steps of the rate.

5. *Low Dollar Investment by Customer.* Now *in*expensive lighting equipment. Silver Bowl Lamps—Low-Priced I.E.S. Lamps—Decorative-Study-Hobby—Mazda Bulbs.

6. *Light Conditioning.* Surveys prove big field. Science of Seeing proves higher intensities needed—700,000 customers need Better Light for Better Sight.

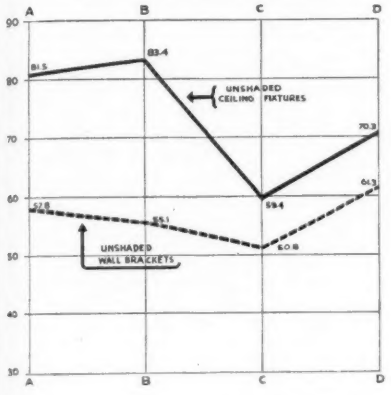
7. *Builds Up Low Use Customers.* 50 per cent—33 1/3 per cent—25 per cent of our customers are low-use unprofitable customers. Lighting is the Number One Builder-Upper.

8. *Low Cost Sales.* Everyone tells us—so it must be true—there is more revenue per dollar expended for lighting equipment than for any other electric or gas appliance.

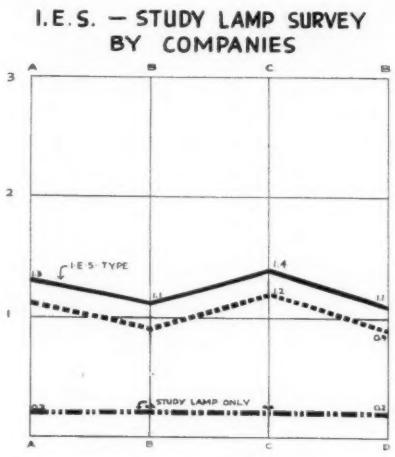
9. *Reaches 100 Per Cent of Customers.* Every customer is a lighting customer. Every advertisement—every service call—every salesman's approach has the greatest opportunity for making a sale, because many suspects can be turned into prospects that result in sales by every employee.

What a House-by-House Lamp Survey Showed

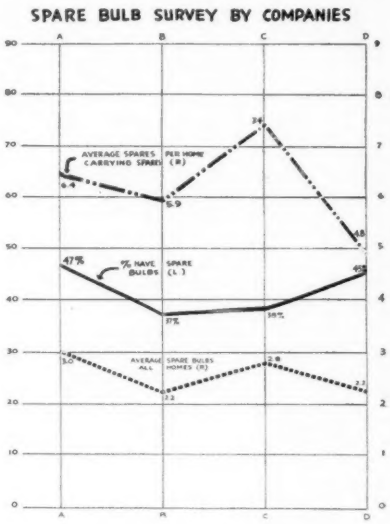
Middle West lamp sales are high, have risen sharply in dollars and wattage since the inauguration of Fall Lighting Campaigns (Chart 6). Yet, in the territories of four typical companies of the system (A, B, C and D on the charts) more than half the homes have NO spare bulbs, and 60 to 70 per cent have EMPTY SOCKETS—an average of three to the home.



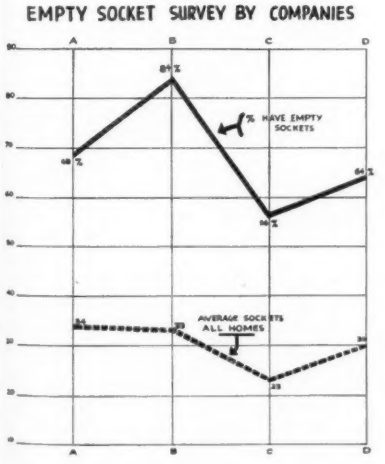
Ceiling fixtures should be shaded for proper use according to Better Light-Better Sight principles, yet the top line shows surprisingly high proportions are unshaded in these four typical territories. Even more startling news appears on the lower line: only 45 per cent of wall brackets are shaded—55 per cent that certainly should be sold shaded fixtures!



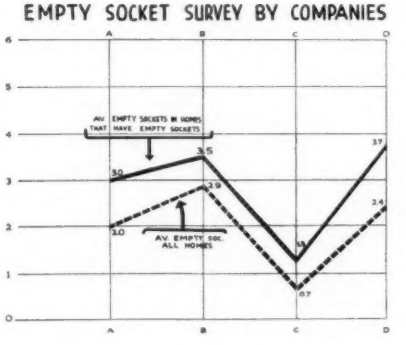
I.E.S. lamps are one of the best revenue producers. Middle West companies have an average of more than one lamp to the home, better than the national record, but the average home can use three or four. And only one in every five homes had an I.E.S. Study Lamp.



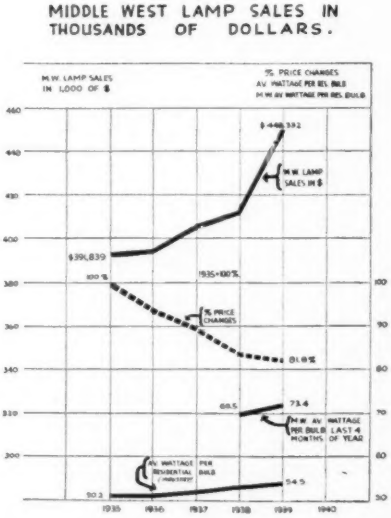
Average stocks of spare bulbs in homes having spares varied from 4.8 to 7.4 in the companies (top line). But because only 37-47 per cent had any spares at all (second line) the averages for all homes are much lower (bottom line). Middle West companies sold four million lamps last year—to less than half their customers.



Percentages on the top line should be considered, by companies, in relation to the averages on the lower line. Homes having stocks of spare bulbs are not so likely to have empty sockets.



In three of the territories the homes having empty sockets averaged three or more vacancies per home. Empty sockets use no electricity.



Despite an 18 per cent drop in prices, Middle West lamp sales have risen 14.4 per cent in dollar volume in four years. And the high average wattage of the bulbs sold in Fall Lighting Campaigns proves that these activities are real load builders.

Better Relations Through Personalized Service

PART II—A SAMPLE PROGRAM

By C. M. Turner

Assistant to Vice President, Ebasco Services, Inc.

THE objectives of the Customer Service Program, its benefits to the customer, and its advantages to the Company were enumerated in Part I of this article.

It is the purpose of this section to outline the Program in more detail.

Supervision

The Customer Service Program must have the sanction and active participation of the executive staff of the organization, as should any relations program. Supervision of details, training, and guidance may be delegated to the junior executive or department head best fitted for this type of work. In one company this may be the executive assigned to relations matters, in another it might be the manager of the sales department, and in still another, some person especially qualified in this work. These various methods are being practiced successfully in different sections of the United States.

It is repeated again—and not too often—that this Program must not be tainted with the flavor of merchandise selling, nor must its personnel be permitted to lapse into a department of peddlers. Sales training and technic are essentials, but the supervision must be such as to guide this work along the straight and narrow path of personalized service.

Personnel

The importance of high calibre personnel for contact work is so readily understood that it need not be stressed here. Especially qualified persons are required for the successful application of this Program. For this reason, it is generally necessary to select men from various departments of the Company's organization.

Among the desired qualities for this type of Representative are:

Personality
Intelligence
Appearance
Experience
Interest
Adaptability
Patience

The required number of men of this high type of character is not often found in one department. It generally is necessary to recruit Representatives from the Sales, Accounting, Service, Stores, and other departments. In fact, linemen and station operators have been chosen for this work in some instances, and much to their credit.

It is likewise desirable to procure Representatives within the territorial division to be treated. This might save embarrassment for the Representative and certainly makes it easier to break down sales resistance in a community where there is some acquaintanceship.

Instruction

The personnel chosen should be given a course of instruction lasting from two to four weeks. Daily meetings should be held, and the training course conducted by executives and department heads most familiar with the particular subjects under discussion. All of the functions, responsibilities, and policies of the departments should be explained in detail to the Representatives. It is essential, in a program of this nature, that the Representatives be taken into complete confidence, and every policy, method of operation, and reasons for executive decisions outlined and fully explained.

The course should be complete in its presentation with illustrations, charts, maps, and literature. It is desired, of course, to make these Company Representatives the best advised persons on the subject of utility operation which the Company could possibly place at the disposal of inquiring customers. Having been saturated with all of the essential information, the Representatives also must be trained in the effective presentation of the data in order that the greatest public acceptance will be had.

It will be found that as soon as this intensive training course becomes known to other persons in the organization, there will be a demand on their part for similar treatment. This information course may grow to a point where all employees will take a more active interest in the affairs of the Company. Such thirst for knowledge and eagerness for participation should not be discouraged.

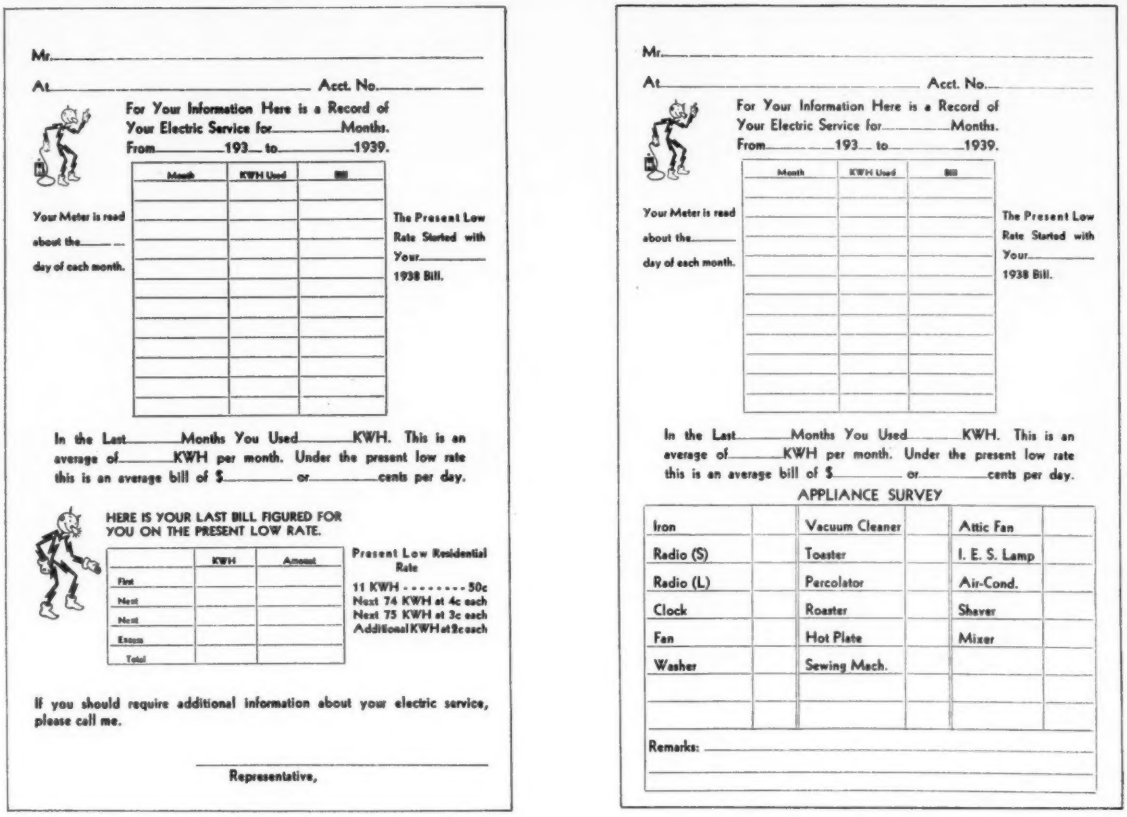
Among the many items included on the list of subjects to be covered in the course of instruction are these major points:

History and development of public utility industry
History and development of the Company
Economics of electric utility operations
Company organization and financial structure
Company policies
Departmental functions
Rates, rules and regulations
Production, transmission and distribution investment
Production, transmission and distribution operation
Effects of peaks
Extension of service
Distribution of revenues
Expenses
Taxes
Trends
Meters and meter reading
Dealers
Appliances and wiring
Competition
Service and Holding Companies
Holding Company Act
Federal and municipal projects and operations
Government regulation
Federal agencies
Current legislation
Local matters of interest

Questions become a major part of this course. Representatives should be encouraged to develop and ask as many questions pertaining to our business as possible and should be given the experience of answering them personally.

In order that the Representative will have sufficient and convincing back-up data when discussing these subjects with the customer, he should be furnished with a looseleaf notebook containing necessary graphs, charts, maps, tabulations, and illustrations. This book is an important tool and must be prepared in a neat manner, and in a way sufficiently attractive to impress the customer with the simplicity and accuracy of the correct answer.

After the beginning of active participation in the program, it is desirable to hold periodic conferences during which difficult situations might be discussed with all Representatives for their enlightenment.



Mr._____

At_____ Acct. No._____

For Your Information Here is a Record of Your Electric Service for_____Months. From_____193__ to_____1939.

Month	KWH Used	Bill

Your Meter is read about the_____ day of each month.

The Present Low Rate Started with Your_____ 1938 Bill.

In the Last_____Months You Used_____KWH. This is an average of_____KWH per month. Under the present low rate this is an average bill of $_____ or_____cents per day.

HERE IS YOUR LAST BILL FIGURED FOR YOU ON THE PRESENT LOW RATE.

	KWH	Amount
First		
Next		
Next		
Excess		
Total		

Present Low Residential Rate

11 KWH - - - - - - - - 50c
Next 74 KWH at 4c each
Next 75 KWH at 3c each
Additional KWH at 2c each

If you should require additional information about your electric service, please call me.

_____
Representative,

Mr._____

At_____ Acct. No._____

For Your Information Here is a Record of Your Electric Service for_____Months. From_____193__ to_____1939.

Month	KWH Used	Bill

Your Meter is read about the_____ day of each month.

The Present Low Rate Started with Your_____ 1938 Bill.

In the Last_____Months You Used_____KWH. This is an average of_____KWH per month. Under the present low rate this is an average bill of $_____ or_____cents per day.

APPLIANCE SURVEY

Iron		Vacuum Cleaner		Attic Fan	
Radio (S)		Toaster		I. E. S. Lamp	
Radio (L)		Percolator		Air-Cond.	
Clock		Roaster		Shaver	
Fan		Hot Plate		Mixer	
Washer		Sewing Mach.			

Remarks: _____

Form 1—Original and Duplicate Residential Customer Service Card

These cards are prepared in advance from customer records in meter sequence and assigned daily to Representatives. They contain a 12-months' record of the customer's consumption, billing and other data helpful to the Representative and the customer in conducting an intelligent interview.

The process of computing the last month's bill by application of various steps in the tariff emphasizes the lowest rate attained as the cost per kwhr of any additional service.

The reverse side of the original form contains an introduction by Reddy Kilowatt, an explanation of a kilowatthour and a list of common appliances with the length of time they will operate on 1 kwhr. Also this statement—

"The electric meter installed in your home measures the number of kilowatthours you use just as scales measure pounds of weight. The electric meter is one of the most accurate measuring devices in ordinary use."

The Representative's duplicate card contains the same customer information as the original except for the box used in computing last month's bill which box is replaced on the duplicate by an appliance service check list to be filled in by the Representative.

The reverse side of the duplicate card is ruled for the Representative's "verbatim" report of the interview.

Routing

As a rule, it is advisable to route the Representatives through the territory in meter book fashion starting them in various sections of the territory in order that a quite typical cross section of customer feeling might be available in the Company's records at all times.

It will be found that the number of call-backs is necessarily large for two reasons; first, experience has shown that nearly 50% of the customers are not at home on the initial call, and second, requests for personal service should be followed up by the Representative to see that they have been taken care of satisfactorily. Along this line, considerable saving might obtain by having meter readers, salesmen, collectors, or others who contact and become familiar with the personal habits of customers' families, indicate on the customer's record when it is most feasible to visit these customers. By so doing, the number of duplicate calls will be reduced.

Some companies, in addition to retaining the regular staff of Representatives, assign one or more of these men to the job of calling on each new customer, or each new re-connect, to render any little service which might be desired on the part of the customer. It has been found in some instances that invidious comparison of rates, service, and policies between the subject Company and the Company serving in the territory from which the customer moved, might be prevented and a friend made. Likewise, some of these Special Representatives may be assigned to handling complaints, particularly high bill complaints.

The Interview

To the majority of customers, electric service is still an intangible and mysterious operation which amputates part of the family income. The approach to the customer, therefore, must be on the

basis that he knows little or nothing of electricity, or his electric service, the industry, the Company, or its business. The interview should be for the sole purpose of rendering service to the customer with a positive affirmation that the Representative has no merchandise to sell. Discussions should be kept on a friendly basis and not extended beyond the point of interest to the customer, who incidentally appreciates our problems only insofar as they affect him personally. Neither should the interview be so short as to fail in drawing out any complaints which the customer may be harboring.

The initial service of the Representative should be the display and discussion of the customer's consumption and bill for each of the past twelve months. These figures should be tabulated on a slip (Form 1) to show the average monthly cost and average daily cost of complete electric service. Comparisons should be made between the average daily cost of service and other incidentals which customers without thought or criticism usually purchase in their daily habits.

The second item of service which the Representative should render to the customer is the determination of operating cost of each appliance. This computation should be performed in front of the customer on a printed slip (Form 2) to be left with him upon departure. The cost should be based upon the hours use of each appliance as estimated by the customer himself and when totaled should approximate the average bill shown on Form 1. The customer is generally surprised at the small average daily cost of service and at the low incremental cost of using his present, or his long desired, appliances. In the discussion of appliances, the Representative should endeavor to offer suggestions by which the customer might reduce wasted consumption.

If the cost of operating a particular appliance is questioned, or the subject of faulty meters arises and becomes of major importance, the Representative should report the matter to the service department for immediate test on adjustment. If a minor adjustment, such as the repair of an appliance cord, is mentioned by the customer and can be repaired by the Representative, this should be done in order that the customer may again have the use of the appliance which has been out of service.

Mention has been made of the Representatives' Manual containing charts, curves and tabulations as an aid in pictorially answering questions asked by customers. The customer should be encouraged to ask questions regarding any phase of the Company's business or of the electric utility industry as it is in this way that we learn where the misunderstandings are and correct them. Some of the questions may be unique and others follow a beaten path. The Pictorial Manual affords an excellent way for making the answer understandable.

With as much service as possible rendered, questions answered, misunderstandings corrected, complaints satisfied, and helpful suggestions recorded the Representative should take his leave courteously, requesting the customer to call him personally if he can be of any assistance in the future.

Mrs. _____

If You Will Tell Me How Many Hours You Use Your Appliances I Will Tell You How Little It Costs You To Operate Them.

AVERAGE COST OF OPERATING ELECTRIC APPLIANCES	NUMBER OWNED	HOURS USED PER WEEK	COST PER WEEK
AN IRON 2 3/5c Per Hour			
A SMALL RADIO 1/5c Per Hour			
A LARGE RADIO 2/5c Per Hour			
A REFRIGERATOR— OPERATING COST VARIES ACCORD TOO TO SIZE OF BOX USE ETC.			
A CLOCK 6c Per Month			
A FAN 1/5c Per Hour			
A WASHER 1 1/5c Per Hour			
VACUUM CLEANER 1 2/5c Per Hour			
A TOASTER 2 1/5c Per Hour			
A PERCOLATOR 1 3/5c Per Hour			
A SEWING MACHINE 1/5c Per Hour			
A ROASTER 4c Per Meal			
A WAFFLE IRON 2 3/5c Per Hour			
A MIXER 1/3c Per Hour			
AN ELECTRIC SHAVER 2/5c Per Month			

The Cost Per Month Would Be 4 1/3 Times _____
(4 1/3 WEEKS PER MONTH)
or _____

Please Call Me If I Can Assist You

_____
REPRESENTATIVE

Form 2—Residential Customer's Appraisal Slip

A means of evaluating customer's appliance service, prepared in the customer's home and with his or her assistance. The Representative bases his computations on the number of hours' use estimated by the customer.

Enumerating each service and computing its respective cost provides an opportunity for discussion of such operating costs and value of service. The difference between the total cost of operating the appliances listed and the customer's average bill shown on Form 4 represents the lighting cost and pictures for the customer the difference between a lighting and a service bill.

The form is left with the Customer.

Reports

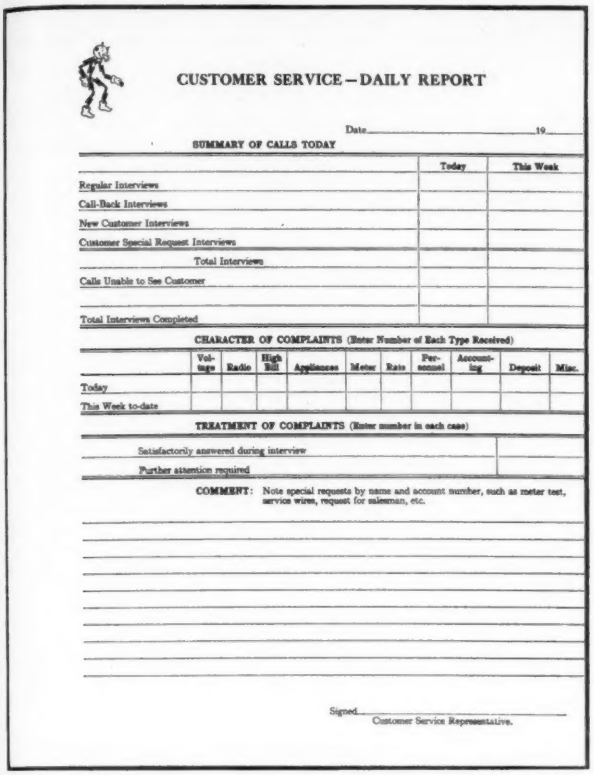
As a rule, the Representative will have ample time, in the early morning and late afternoon, for making out reports since these hours are inconvenient for interviewing purposes.

In large communities, the forms containing the customer's monthly consumptions and billings should be prepared by clerks in the accounting department and made available to the Representatives daily. In very small communities, or in rural territory, these slips may be made up by the Representative himself during the early hours of the day, or in the late afternoon.

In order to have a more sensitive feeling of the customers' pulse the report of each interview, as recorded by the Representative, should be written in the customer's own words as nearly as the Representative can remember them. These reports, many of which may establish company policies, are of great importance, but in order to in no way influence the thinking of the customer, no writing should be done in his presence except that for computing the cost of operating appliances. The reports should be carefully read and tabulated in accordance with predetermined headings for analyzing customers' attitudes and for determining Company policies, practices, and regulations which appear to be irritating to the customers.

All of the service requests should be sent to the various departments on special forms by the Program Supervisor and should be followed closely to see that every reasonable desire of the customer is taken care of satisfactorily. Copies of the Representative's report of interview should be sent to departments which have been subject to criticism, or to those which are affected in any way by the interview.

The executive staff should also be furnished with copies of these interviews for their information, comments and suggestions. The original file of these reports should contain flags for indicating favorable or unfavorable attitude, and other matters.



CUSTOMER SERVICE—DAILY REPORT

Date ..... 19....

SUMMARY OF CALLS TODAY

	Today	This Week
Regular Interviews		
Call-Back Interviews		
New Customer Interviews		
Customer Special Request Interviews		
Total Interviews		
Calls Unable to See Customer		
Total Interviews Completed		

CHARACTER OF COMPLAINTS (Enter Number of Each Type Received)

	Voltage	Radio	High Bill	Appliances	Meter	Rate	Personnel	Accounting	Deposit	Misc.
Today										
This Week to-date										

TREATMENT OF COMPLAINTS (Enter number in each case)

Satisfactorily answered during interview	
Further attention required	

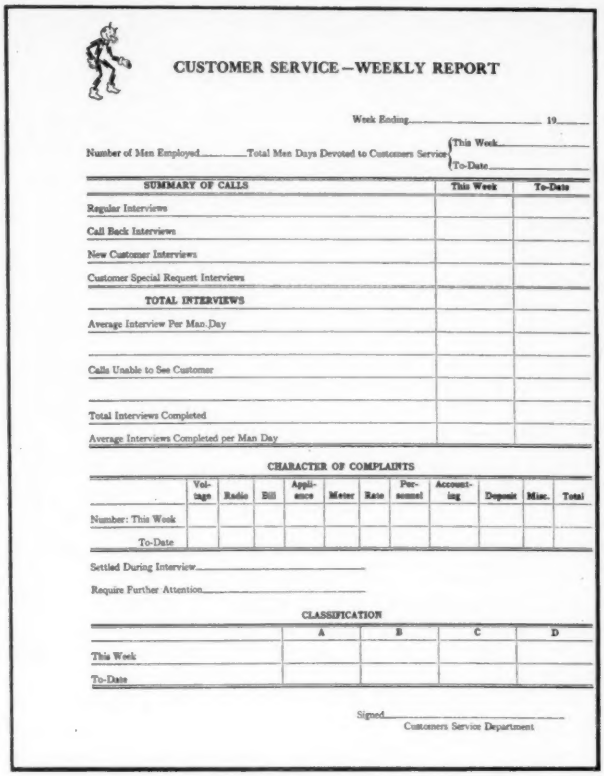
COMMENT: Note special requests by name and account number, such as meter test, service wires, request for salesman, etc.

Signed .....
Customer Service Representative.

Form 3—Customer Service Representative Report

Form 3 is filled in daily by the Representatives as a means of keeping the supervisor and the executives informed of progress.

It shows the number of completed and uncompleted interviews, character of complaints and comments on special requests. Summary forms adopted by some companies show more detail, such as number of man-days, number of calls and number of interviews per day.



CUSTOMER SERVICE—WEEKLY REPORT

Week Ending ..... 19....

Number of Men Employed ..... Total Man Days Devoted to Customers Service { This Week ..... / To-Date .....

SUMMARY OF CALLS	This Week	To-Date
Regular Interviews		
Call Back Interviews		
New Customer Interviews		
Customer Special Request Interviews		
TOTAL INTERVIEWS		
Average Interview Per Man Day		
Calls Unable to See Customer		
Total Interviews Completed		
Average Interviews Completed per Man Day		

CHARACTER OF COMPLAINTS

	Voltage	Radio	Bill	Appliance	Meter	Rate	Personnel	Accounting	Deposit	Misc.	Total
Number: This Week											
To-Date											

Settled During Interview .....

Require Further Attention .....

CLASSIFICATION

	A	B	C	D
This Week				
To-Date				

Signed .....
Customers Service Department

Form 4—Customer Service Supervisor's Report

The Customer Service Supervisor's Report, Form 4, is similar to Form 3 except it is filled in by the Supervisor as a recapitulation and summary for Executives and Department Heads.

Sales Prospects

The Representative should assure the customer that he has no merchandise to sell and his word must guide his actions or the program will become a waste of money. It is for this reason that one Company states,

"In one district, the calls were given a commercial slant by offering small items of merchandise for sale, but it was found that this practice set the call up in the mind of the customer as 'just another salesman' and so lost its effectiveness."

A similar reaction will be obtained from the customer if the Representative, having found that the customer would like to purchase a new lamp or a range, follows up his call in a short time with such an appliance and a persuasive sales argument. In this case, the first thought in the customer's mind is apt to be, "You took advantage of my confidence when admitted to my home."

Along this line, it is understood that some companies have endeavored to use their "All Service Salesmen" on the Customer Service Program, thus enabling them to follow up on prospects which have been obtained in the manner described above. It might be suggested that if this procedure is desired, the actual sale of appliances should be conducted by someone other than the party who made the service call.

No prospect should be revealed to a dealer or the sales department except at the request of the customer, or with the customer's permission. Many times the customer not only grants permission, but expresses his choice of dealers and, in such cases, reports should be made to the proper parties or referred to the Company salesmen for definite appointment.

Prospects for such major appliances as ranges, refrigerators, or dish washers should be referred to the Home Service Bureau which maintains a list of such prospects. These prospects may later be invited to cooking schools and demonstrations to stimulate further interest.

Forms

Sample forms used by one of the companies are shown in these pages with appropriate descriptions. The type and number of forms of course vary with taste but the four major ones illustrated here do not differ greatly among companies. Miscellaneous forms for reporting complaints, follow-up of requests, record of representative's cards etcetera should be provided.

It will be found helpful to have forms for tabulating or classifying remarks of all kinds, questions, suggestions, complaints and comments, as an aid in analyzing customer attitude, effect of Company policies, prospective market, success of this and other programs and as a means of determining methods for broadening friendship, mutual understanding and service.

Electrical Equipment Committee Meeting

R. W. Wilbraham, *Chairman*

ADEQUATE and reliable electric supply for all possible demands that might arise during the present emergency formed the basic topics for discussion at the Electrical Equipment Committee meeting held at the Hotel Jefferson, Richmond, Va., Oct. 7 and 8. About fifty engineers attended the two-day meeting of this committee.

The first day was devoted entirely to a closed session meeting where many interesting and timely design and operation problems were discussed.

C. A. Corney presented a summary of the Eighteenth Report on Apparatus and System Troubles. In addition to the general presentation of this summary detailed discussions were presented of several of the more interesting and important instances which have been experienced in the past few months. This discussion brought out the means which have been developed to eliminate the possibility of the recurrence of such difficulties.

R. N. Conwell, as sponsor for the study of oil fires, pointed out that he was pleased to be able to report only several minor occurrences, as no serious fires of this nature had occurred in the industry during the preceding several months.

R. T. Henry reported that the Sectional Committee had completed its work on the proposed new circuit breaker standard and that it is expected that this pamphlet will be available in printed form before the end of the current year. The 75,000 kva indoor oil circuit breaker has been removed from the preferred schedule of ratings in the 5, 7½ and 15 kv classes. In connection with the removal of this breaker from the preferred list the 50,000 kva breaker which will retain its present ratings will be made an oil-tight breaker. Progress is being made in the development of standard ratings for indoor oil-less circuit breakers below 10 kv and outdoor oil-less circuit breakers above 10 kv.

A Progress Report was made by A. P. Fugill on the study of transformer noise. At the present time there is a tendency to make changes in transformer designs which will result in increased noise. This increased noise may in many cases prove a serious problem in connection with the operation of transformers in otherwise quiet areas.

A very interesting presentation of the study of load swings and governor characteristics was presented by J. E. McCormack. This paper presented the results of shifting large blocks of load, modified governor characteristics, etc., on the load and frequency of a large interconnected utility system.

K. F. Bellows presented a report summarizing the second year returns from a questionnaire on forced outages of steam turbo generators. This study covers 325 individual units with an aggregate capacity of over 12,000,000 kw. The actual operating data obtained from this large group of machines is being carefully studied so that all factors involved in the probability of outage of one or more machines at the time of peak load can be accurately forecast.

A careful study made under the sponsorship of J. H. Foote has shown that there is insufficient demand in the industry at the present time for special motors of lower voltage rating for use on three-phase four-wire network, or three-phase four-wire radio secondaries of the 120/208 or 115/199 volt classes.

The final report of the AIEE subcommittee on Power Supply for Welding Operations has been completed. This report, "III. Factory Wiring for Resistance Welders" supplements the two previous reports, "I. Guide to Good Electrical Performance of Resistance Welding Machines" and "II. Resistance Welder Installations." In addition to preparing this report, the subcommittee has prepared purchase inquiry forms and manufacturers data sheets which outline in detail all essential information that prospective users should furnish both the manufacturer and the local power company. Many power companies have derived great advantage from sending the two previous reports to their customers interested in this subject, and it is expected that this third report and the forms will be of equal merit. The report and forms should be ordered from Mr. L. W. Clark, Detroit Edison Company, Detroit, Michigan.

A report on Utilization Terms and Definitions was presented by J. H. Foote. This report, and the definitions, are published in this issue of the BULLETIN. It is expected that the trial use of these definitions will prove of great advantage not only in the work of the Electrical Equipment Committee and the Transmission and Distribution Committee, but in the day-by-day work of the individual companies. A new meter has been developed for measurement of the terms used in these definitions and it is hoped that many companies will obtain one or more of these meters so that wide operating experience will be obtained.

O. B. Benson of the Boston Edison Company, Chairman of the Storage Battery Subject Committee, presented a report outlining the study being made by the committee of problems associated with the operation and maintenance of both control and standby batteries. The manufacturers have recently proposed that rubber jars be accepted as standard for the control batteries in place of the present glass jars. There was strong feeling of the committee members that the glass jars were more suitable to the utility companies' requirements, and that every effort should be made to maintain the glass jar as standard for this service.

R. L. Webb presented a progress report on the study of generator insulation. In connection with modernization programs there have been several opportunities to obtain complete test data on generator windings in good condition and artificially damaged prior to the rewinding of the generator. Although the subject committee has not yet determined an entirely satisfactory method for non-destructive tests of generator insulation, great strides have been made and much fundamental data obtained.

A paper by E. Brokemyr and K. F. Hawley, describing the differential relay protection for the Safe Harbor 13 kv 60 cycle buses, was presented. This paper showed the great strides which are being made in the development and installation of apparatus to insure, as far as possible, continuous electric service, and minimize as far as possible damage which might occur under fault conditions.

J. O'R. Coleman presented the results of a field investigation of the radio field strengths under and around various 220 kv lines in the Middle Atlantic States. This investigation was made as a result of tentative regulations relating to the location of transmission lines around airports from the standpoint of possible radio interference. The investigation showed that the radio field strengths emanating from lines under normal condition dropped to values below the sensitivity of the measuring in-

struments within several hundred feet normal to the line, also, that field strengths above 5 or 6 megacycles were negligible under normal operating conditions. It is expected that this information will be of great value as a technical basis for working out the problems of coordination of line location around airports so as to avoid interference with airway communication.

The following report of the Meter and Service Committee was presented before the Electrical Equipment Committee for its review.

Meter and Service Committee Meeting

F. E. Davis, *Chairman*

REPORTS on the work of the Meter and Service Committee, E.E.I., given at the fall meeting of the Committee, held at Kansas City, Mo., Sept. 26, show substantial progress in the various activities and studies undertaken by this group. The full membership of the Committee was present at the meeting. These, with guests including the corresponding A.E.I.C. Committee and members of the Meter Group of the Missouri Valley Electric Association, brought the attendance to a total of 56.

Printed Standards

Two printed suggested standards have been issued under the sponsorship of the Committee, one regarding standard dial constants (E.E.I. Pub. MS-1), the other dealing with the low voltage current transformers (E.E.I. Pub. MS-2). It is suggested that all operating companies study these two proposals closely for adoption if they have not already been put into practice. The Committee would also appreciate advice as to any apparently insurmountable obstacles which may be considered to be in the way of their adoption. It is hoped that their use will become practically universal in the near future.

Several additional subjects are about ready for printing and probably will be available in the next year.

Current Transformers (Indoor Types—primary voltages)

The subcommittee on current transformer standardization reported the development on the part of one manufacturer of a low burden current transformer with reasonably good characteristics from a very small primary current to 200 per cent of its primary current rating which it is capable of standing continuously. The long load range characteristic is considered to be important in current transformers because of the possible reduction of the number of sizes required and because service changes need not be made to the same extent as with 100 per cent maximum rated transformers. However, it is considered that the limited burden ability in a reasonable accuracy range is particularly severe and would probably require another complete line of current transformers on the part of the manufacturers. There is also the possibility that present transformers have sufficient range to accomplish the purpose with reasonable meter accuracy provided a transformer of present types of twice the required rating were used in a given situation. This would provide for a reduction in number of sizes and service changes and would eliminate the burden limitation but at any given primary current, the meter would be operating on 50 per cent of the current value which would be available with the 200 per cent rated transformer at the same primary current. This would undoubtedly increase the probable variations in meter accuracy at extreme light loads and is considered a serious fault by some although the general opinion seems to be that such variations during the extreme periods would not be particularly significant in total registration.

In order to determine in a quantitative way what the actual differences may be, the subcommittee is to outline proper procedure for a series of field tests to be carried out by those members who wish to do so and which can now be done since the low burden 200 per cent transformer is available. These tests will have to be over a period of time and no results should be expected immediately.

At a previous meeting tentative sizes of transformers and dimensional specifications were adopted and these will be referred to the manufacturers for comment. The subject of insulation levels is being held in abeyance until more definite action by other interested groups is taken.

Service Cable

As a result of an informal meeting between members of the E.E.I. Service Cable subcommittee and cable manufacturers held recently in New York, the project of the committee has been submitted to the Service Cable subcommittee of the Power Cable Group of N.E.M.A. and the E.E.I. subcommittee have been assured of their interest in the development of a more universal type and that a number of manufacturers are actively investigating new materials and constructions toward this goal.

Service Entrance Devices

Because of extensive developments in the use of automatic circuit breakers as service entrance devices, the committee will study the situation from the standpoint of the possibility of increased use and effect on service costs for work on customer premises.

Standardization of Demand Register Scales

A revised report considering suggestions and comments made on the original report will be issued shortly and apparently it will be possible to reach substantial agreement on a simplified series of registers and scales which will eliminate much of the present confusion both for the manufacturers and users of these devices. Some further work is yet to be done but the results of this study of a most complicated subject, when available, should be most useful and valuable to the industry, especially since the use of such devices is apparently increasing.

Standardization of Thermal Demand Meter Ratings and Scales

While this subject does not have all the ramifications of the Demand Register Scales subject discussed previously, it is apparently one of sufficient variations to make it quite difficult to arrive at a single series to which all can agree. Progress is being made toward this end, however, and in view of the increasing use of these devices it is of particular importance that a single series of ratings and scales be settled upon.

Cyclometer Registers

A careful study has been made of the more important aspects of standard registers as compared with the cyclometer type. This showed that because of reading difficulty, the cyclometer defeats the very purpose for which it is intended.

Cumulative Demand Registers

A new subcommittee has been appointed to collect all pertinent information regarding both the disadvantages

and advantages of this type demand device. There appears to exist at present a misconception regarding the value of such devices for the solution of certain reading problems in connection with the use of demand indicating meters and the purpose of the subcommittee will be to provide authoritative information regarding the subject.

Joint Committee with A.E.I.C. Meter Committee and Meter Manufacturers

It has long been an objective of the Meter and Service Committee to eliminate, in so far as possible, requirements on the part of individual users of meter equipment for special features for which there is little or no other demand in the industry. Such requirements tremendously complicate the problems of manufacture and distribution and unless special charges are made for such special features, costs for those having no special requirements are undoubtedly affected adversely.

In an effort to find a way in which closer cooperation in this endeavor may be established, the committee has appointed a temporary subcommittee to meet with a similar subcommittee of the A.E.I.C. Meter Committee and representatives of the meter manufacturers to discuss informally the objective of this effort and develop a practical means of its accomplishment for recommendation to the committee. It is believed that in this manner a procedure can be set up which will meet with the approval of all concerned and which when placed in operation will result in considerable benefit to the industry and progress in the meter art.

Safety Practices

A new subcommittee has been designated to handle this subject but no specific problems have as yet been referred to it. It is, however, ready to function and questions relative to safety practices in meter work should be referred to it.

Relations with AEIC Committee

Ten members of the Committee are also members of the AEIC Committee on Metering and Service Methods. The two committees have been meeting on successive days, each group being invited to attend the other's meeting. To eliminate repetition of subject matter under this practice, a division of work between the committees has been agreed upon. Information will be exchanged and both chairmen will attend both sessions.

Prime Movers Committee Witness Test on New Type 82,500-Kva Generator at Westinghouse Plant.

Prime Movers Committee Meeting

E. L. Hopping, *Chairman*

FINAL consideration of several reports now nearly ready for publication, discussion of operating problems and general protective measures largely occupied the attention of the Prime Movers Committee of the Institute at its fall meeting, held October 7 and 8 at the William Penn Hotel, Pittsburgh.

James F. Muir, chairman of the Subcommittee on Boilers and Combustion, submitted the proposed Committee statement to accompany the subcommittee report, and discussion led to several changes. The Editing Committee will soon complete its work on this report, prior to early publication.

There was also lively discussion of the statement for the Turbines and Condensers Subcommittee report, read by G. C. Daniels, chairman. The report will be submitted to the Editing Committee before the December meeting.

M. D. Engle, chairman of the Boiler Auxiliaries Subcommittee, stated that nearly all material for his report had been collected, but the Committee statement could not yet be presented.

The Chemistry Subcommittee report will be ready for the Committee's consideration at the December meeting, H. C. Miller, chairman, announced.

The Boiler Code and the Code for Pressure Piping will be brought more nearly into agreement by proposed revisions prepared by the A.S.M.E. Boiler Code Committee. H. N. Boetcher, chairman of the Metallurgical Subcommittee, distributed copies of the revisions to members of the Prime Movers Committee, which has been actively interested in the problem for the past year.

Mr. Boetcher submitted a preliminary report on bolt material failure and its causes, one of the subjects considered at the Round Table discussion. J. A. Keeth led the Round Table.

H. M. Drabelle submitted a mimeographed report of the Oil and Gas Engine Subcommittee. It contains data which should prove valuable to sales engineers of all companies.

F. S. Clarke gave the members a brief description of the 2000 lb, 960 deg forced circulation boiler and turbine which is to be installed at the Montaup Electric Company's plant at Fall River, Mass.

On Monday evening all the members visited the East Pittsburgh works of the Westinghouse Electric and Manufacturing Company, where they witnessed a test on an 82,500-kva generator and direct connected exciter, operated at full speed with and without the field. The generator, a 3600-rpm machine, is of a new design in which the armature is supported on struts for the purpose of eliminating vibration or greatly reducing it.

Empire State Convention Held at Rye

THE utility companies of New York State have built up a usage of electricity greater than that of any other place on earth, Floyd L. Carlisle, chairman of the board, Consolidated Edison Company of New York, declared in an address delivered at the 35th annual convention of the Empire State Gas and Electric Association, held Sept. 26 and 27 at the Westchester Country Club at Rye, N. Y. Due to such efforts, he said, great cities have come into being, industry has flourished and the typical American family has come to enjoy the world's highest living standards.

With regulatory, tax and political matters demanding so much of the time of utility executives, it is important that these executives frequently reaffirm their "only purpose for being in business: to render gas and electric service to the public on a basis that is sound to us and sound to our customers," Mr. Carlisle said.

Edward P. Prezzano, retiring president of the Association, asserted in his opening address that the electric and gas companies of the state are now better prepared than ever before to meet all demands for service arising from national defense preparations. The companies pledge their efforts to the maintenance of "the American concept of American democracy with freedom and opportunity to all," he stated.

Irving K. Peck, president, the Binghamton Gas Works, was elected president of the Association for the ensuing year. John L. Haley, president, Central New York Power Corporation, was elected vice-president and Herbert C. Davidson, vice-president, Consolidated Edison Company of New York, was elected treasurer.

The needs of the human eye in adequate indoor lighting were discussed by D. S. Youngholm, vice-president, Westinghouse Electric and Manufacturing Company. Present-day lighting meets these needs only to the extent of three per cent, he said. He credited the Better Light-Better Sight campaign with much of the increase in sales of both incandescent and fluorescent lamps. He predicted sales of 575,000,000 incandescent lamps for 1940, as compared with 531,000,000 in 1939. Fluorescent sales for this year will be 7,500,000, as against 2,500,000 sold two years ago, he said, and with the utilities continuing to cooperate in sales promotion, the industry can look forward to a "golden age of lighting."

Dannie Heineman, president of Sofina, the great European holding company, gave the convention a report of the effect of war on utilities abroad. Many of the Belgian turbo-generators, dismantled before the invasion, are again in operation, he said, and the destruction of power plants by bombing has been less than might be expected.

The problems facing utilities and regulatory commissions in the matters of financing, depreciation and other accounting questions were the subject of the address of Milo R. Maltbie, chairman, New York Public Service Commission. Emmett F. Connelly, president, Investment Bankers Association, spoke on standards for financing. The present bond situation constitutes a "seller's market," he said, and utilities should guard against over-pricing new and refunding issues.

Study of the farmer's needs is a prime requisite for utility companies who wish to serve the farms, said H. E. Babcock, chairman of the board of trustees, Cornell University. Understanding service now being rendered the farmer through the activities of rural service engineers is already changing the attitude of farm people toward the utilities, he declared, and the expansion of rural usage per customer will further improve this relationship as well as reacting favorably on the financial statements of the companies.

Recreation for the delegates and their wives was provided by a golf tournament for men, motor trips and bridge for the ladies and a reception followed by dinner dancing and entertainment.

Edward F. Barrett, president, Long Island Lighting Company, was general chairman of the convention.

Rocky Mountain Electrical League Meeting

MORE than half of the 48 states were represented by the 300 delegates attending the annual convention of the Rocky Mountain Electrical League held at Albuquerque, N. M., Sept. 9-11, coincidentally with the celebration of the 400th Anniversary of Coronado's explorations in the Southwest.

Gaylord B. Buck, Public Service Company of Colorado, told the convention that street and highway lighting presents the big opportunity for the future, comparable to the I.E.S. activity and the kitchen modernization program, summing up the thought embodied in the dramatized presentation on street and highway lighting by Murray Graff, General Electric Company, which included a demonstration of the theory and application of the new street lighting evaluator by Kirk M. Reid of the General Electric research laboratories at Nela Park.

As another feature of this presentation, Dana Rowten, Public Service Company of Colorado, outlined the program of the Rocky Mountain League with respect to improving street and highway lighting in the three states in which the league operates, Colorado, Wyoming and New Mexico. He told also of recent improvements in street and highway lighting in Denver, employing fixtures using one 400-watt mercury-vapor lamp and two 100-watt Mazda lamps on streets and sodium-vapor lamps on viaducts, which has been effective in reducing fatalities at night. A relighting program has been drafted for the entire city, he added, which would require some five to ten years for completion.

The principle of fluorescent lamps was explained and demonstrated by C. F. Jensen, Westinghouse Electric and Manufacturing Company, St. Louis, who urged that fluorescent lamps be thought of as a new tool or device, rather than as a new lamp. W. B. McKechnie, also of Westinghouse, recommended that fluorescent lighting installations be sold on the basis of providing "Better Light-Better Sight." A. J. Walter, of General Electric's incandescent lamp department, stressed the need for increased attention to designing fixtures for the new tubular light sources.

H. T. Rankin, Public Service Company of Colorado, chairman of the league's lighting division, reported the successful conduct of two fluorescent lighting schools by the league during the past year.

At a dramatized presentation on adequate wiring delegates showed interest in a portable kit developed by Ralph E. Johnson, Sturgeon Electric Co., Denver,

which illustrated the effect of operating various appliances at normal and at 10 per cent below rated voltages.

Recent central station apparatus developments were described by A. C. Monteith, engineering manager of Westinghouse's central station section. He said that more than 90 per cent of the generating units installed in the past five years had been hydrogen-cooled units.

At the annual banquet, on September 9, Ralph E. Johnson, chairman of the league's adequate wiring division, received a citation for his contribution to this activity. Don C. Germond, Mountain States Power Co., Casper, Wyo., received the league's award for outstanding accomplishment during 1940, for the effective dealer-cooperative program in his company's territory.

New officers of the league elected for 1941 are: Gaylord B. Buck, president; Arthur Prager, Albuquerque Gas and Electric Co.; W. D. Johnston, Mountain States Power Co., Casper, Wyo.; Luke Storey, Home Gas and Electric Co., Greeley, Colo.; Ross E. Adams, Hendrie & Bolthoff Co., Denver, vice-presidents. W. C. Sterne, Arvada Electric Co., Arvada, Colo., and George E. Lewis, Denver, were reelected treasurer and secretary, respectively.

Wisconsin Accounting Convention

STATEMENTS that Wisconsin users of electricity are being overcharged are based on "phony" yardsticks, C. E. Kohlhepp, vice-president, Wisconsin Public Service Corporation, told the accounting section of the Wisconsin Utilities Association at their convention held Sept. 16-17 at Green Lake. "These fallacious yardsticks are being used with a total disregard of all our American principles of fair play," he declared.

The fallacy in the so-called yardsticks is that they compare Wisconsin rates with the lowest rates in the nation, without considering variations in costs of production and distribution, standards of living and other controlling factors, he explained. "Comparisons of the charges for food, clothing, rent or virtually anything else used by the public would be equally misleading."

Referring to the recently published statement that Wisconsin electric companies make an annual overcharge of $17,960,000, Mr. Kohlhepp pointed out that the total gross income of the companies is only $16,399,117 and therefore the alleged overcharge is mathematically impossible. He urged accountants to help spread the facts.

A. P. Gale, vice-president, Wisconsin Power and Light Company, and president of the Association, cited facts on rural service to disprove widely spread statements to the effect that farmers would not have electric service except for the Rural Electrification Administration and other government agencies. Eighty per cent of the rural electric customers in Wisconsin are served by the privately owned companies, he said, and not all the remaining 20 per cent are served by R.E.A. cooperatives. Private companies sell 88 per cent of the electric energy used by rural customers in the state.

The private companies have not neglected the farmer either before or since the advent of R.E.A., Mr. Gale said. "Electric companies pioneered in rural electrification and developed plans and programs which were borrowed by R.E.A. Before R.E.A. had served a single Wisconsin co-op member, privately owned utilities were supplying electric service to more than three times as many rural customers as were being served by all Wisconsin co-ops at the beginning of this year." He further declared that rates of the private companies are lower, on the average, than those paid by R.E.A. customers.

There have also been intimations, he said, that the utilities are not keeping abreast of defense needs, whereas the truth was that Wisconsin companies had actually anticipated such needs. "We have ample spare capacity to take care of all requirements now on the horizon. New plants, new lines and new interconnections are even now being built as a precaution for even greater war defense demands than are now visible."

Robert J. Johnson, assistant secretary-treasurer, Milwaukee Gas Light Company, spoke on "Credit—Everybody's Business." Not only do utilities have a credit problem, he said, but the credit problems of other businesses would be far greater were it not for the contributions the utilities make to the community.

"The Necessity for Proper Storage Facilities and Control" was the subject of the address of K. C. Campbell, general storekeeper, Detroit Edison Company. "Conventional stock records are all right up to a certain stage," he said. "But as a finished report, to give a quick and complete picture of conditions, they leave a lot to be desired." Detroit Edison has found the solution for stock control in a fully mechanized system installed in 1939, he said, but smaller companies might have to seek other ways.

P. G. Ellis, budget engineer, Wisconsin Public Service Corporation, spoke on budgets as scoreboards on which proposed goals are chalked up in advance. In addition to the use of accepted devices, he said he regarded budget control as a point of view. "That is, budgetary control can be more effectively and easily accomplished by selling not only management but also each department head on the value of budgets as a constructive rather than a restrictive influence to his operations." He urged that budgets be carefully designed with contemporary business conditions always in view.

J. V. Cleary, Consolidated Edison Company of New York, discussed the current developments in plant accounting from a national viewpoint. He characterized as "encouraging and significant" the progress made in reconciling the views of the accountants and engineers of the regulatory bodies with those of the utilities as to what can be accomplished through the development of original cost and the establishment of detailed plant accounting operations and continuing property records. However, these records will not accomplish miracles and must be designed to operate along practical lines, he emphasized.

Managements of public utility companies deserve the support of all citizens who want to preserve the American form of government, J. E. Waters, Midwest secretary of the Constitutional Educational League, declared.

Other speakers at the convention included C. J. Berner, Wisconsin Electric Power Company; R. C. Horn, Wisconsin Public Service Corporation, and G. R. Klein, Wisconsin Michigan Power Company.

C. E. Hockings, auditor of customers' accounts, Wisconsin Michigan Power Company, was elected chairman of the Accounting Section and H. P. Taylor, treasurer, Wisconsin Public Service Corporation, was elected vice-chairman.

PERSONALS

WILLIAM R. EMERSON, vice-president, treasurer and a director of Oklahoma Gas and Electric Company, has retired from active duty although he will continue as a consultant and adviser to the management. Mr. Emerson entered the employ of the Muskogee (Okla.) Gas and Electric Company more than thirty years ago. He became assistant manager in 1917. Later that year he was transferred to Oklahoma City and made secretary, treasurer and general auditor of Oklahoma Gas and Electric. In 1931 he was elected vice-president and treasurer, and in that capacity he has been very active in the development of the utility accounting system of the Public Utility Engineering and Service Corporation. In commenting on Mr. Emerson's retirement, Mr. J. F. Owens, president, praised highly his handling of finances through periods of both depression and prosperity.

O. A. JENNINGS, vice-president and commercial manager, Oklahoma Gas and Electric Company, has also retired from active duty after 20 years in the company's service. Applying the results of technical training and experience gained in previous employment with the General Electric Company, Mr. Jennings did valuable work in Oklahoma Gas and Electric's early days, especially in the appraisal of properties for purchase. He is well known in the industry as a pioneer in the application of central station electric power to the petroleum industry.

THOMAS E. GRAHAM has been transferred by Oklahoma Gas and Electric from the position of commercial manager, Western Division, to the General Office Sales Department, where his duties will be to aid division managers.

EARLE W. GRAY, formerly in charge of air conditioning promotion for Oklahoma Gas and Electric Company, has been named to succeed Mr. Graham as commercial manager, Western Division.

FRANK J. MEISTRELL has been elected secretary of Union Electric Company of Missouri and its subsidiaries in Missouri, Illinois and Iowa. Mr. Meistrell was until recently assistant to a vice-president of Shell Oil Company.

C. F. MYERS has been promoted by Puget Sound Power and Light Company from assistant superintendent, central division, to general engineering. He joined the company as a student engineer in 1929, after three years in the employ of Stone and Webster, Inc., at Boston. Later he was made distribution engineer at Everett and, in 1937, assistant superintendent.

HARRY V. WILLIAMS, formerly superintendent of electrical distribution for the New York Power and Light Corporation at Troy, has been named superintendent of electrical distribution at Albany, succeeding William Hunter, Sr., retired.

J. H. ESTABROOKS succeeds Mr. Williams in the Troy superintendency, coming from a similar position at Glens Falls.

RAYMOND P. KAESSHAEFER has been elected controller of American Water Works and Electric Company to succeed the late Arthur L. Rae and will assume his new duties early in November. Mr. Kaesshaefer is now manager of the Milwaukee office of Price, Waterhouse and Company.

A. M. MCDONALD, assistant superintendent of power and light for the Puget Sound Power and Light Company at Puyallup, Wash., has been advanced to the position of assistant superintendent in charge of overhead construction in the central division, with headquarters at Seattle. Mr. McDonald has been with the company 15 years.

WALTER HELANDER, local manager at Winlock, Wash., succeeds to Mr. McDonald's former position at Puyallup.

HORACE L. BREWER, formerly purchasing engineer for Commonwealth and Southern Corporation, Northern Division, has been appointed purchasing agent of Consumers Power Company, succeeding the late Charles A. Rice. Mr. Brewer's connection with Commonwealth and Southern companies began in 1924 when he went to work as a draftsman for Hodenpyl, Hardy and Company at Peoria, Ill. He was transferred to purchasing work in 1931 and became purchasing engineer in 1937.

CLAY C. BOSWELL, a director and, since 1934, chief engineer of Minnesota Power and Light Company, has been elected a vice-president. He will continue to function also as chief engineer. Mr. Boswell has had wide experience in the utility business, having worked in the production, accounting and commercial departments of Utah Power and Light Company from 1915 to 1923 and with Electric Bond and Share Company from 1923 to 1929, when he joined Minnesota Power and Light.

MORISON BLAKE, who has served Philadelphia Electric Company in the industrial sales department since 1928, has been appointed director of industrial and retail service to fill the vacancy created by transfer of Harry V. Ryder to another position. A graduate of Harvard engineering school, Mr. Blake previously was employed by General Electric Company and by Stone and Webster.

P. S. ARKWRIGHT, president, Georgia Power Company, has been appointed a member of the Salvation Army's National War Advisory Council. He is also chairman of the Atlanta Salvation Army Citizens' Advisory Board.

DOUGLAS DOW, chief of research, Detroit Edison Company, has been granted leave of absence so that he may serve the U. S. Army as an adviser on procurement of trucks and motor vehicles. He has been commissioned Lieutenant-Colonel in the Quartermaster Corps.

A. S. ALBRIGHT, superintendent of meters, will be acting chief of research during Mr. Dow's absence.

MILTON I. ALLEN has been appointed director of industrial sales for the Main Line and Delaware divisions of Philadelphia Electric Company. He has been a member of the industrial sales department since 1928.

ADOLPH BUSS, for the past four years engineer for the Clintonville district, Wisconsin Power and Light Company, has been named manager of the district. He succeeds the late Walter B. Huebner.

CLIFFORD E. HALL, publicity assistant to C. J. Allen, director of public relations of The Connecticut Light and Power Company, is the author of a feature story included in "Headlining America," recently published collection of the 100 best news stories of 1938 and 1939. Mr. Hall left newspaper work last January to take his present position.

Diversified Demand Method

(*Continued from page 473*)

lines "A" represent the estimated demands based upon the customer data obtained from field surveys and the horizontal lines "B" represent the estimated maximum demands based upon the number of ranges as determined from kilowatthour consumptions.

Whether or not the "diversified demand" method of estimating loads on residential distribution transformers is more accurate than "spot" load checks or load checks which are taken over a period of twenty-four hours or less is a matter for each individual to decide. In making this comparison and decision it should be kept in mind that the maximum demands on transformers, especially those which are serving range loads, are sustained for very short periods of time and usually would not be recorded by "spot" load checks. Furthermore, consideration should be given to the day-to-day variation in maximum demands when comparing this method against twenty-four hour load tests.

National Accounting Conference

(*Continued from page 468*)

tive costs, and engineering and superintendence.

Classification of Accounts

The activities of this group are rapidly taking form under the experienced direction of S. J. Barrett, chairman of the Uniform Classification of Accounts Committee of the AGA and A. M. Hartogensis, who heads the corresponding committee of the EEI. Subjects scheduled to date include: (1) accounting for interchange power; (2) discussion of recent trends in newer uniform systems of accounts in several states; (3) problems of uniform classification in system companies; (4) putting the system of accounts to work, and (5) can benefits be derived by classifying operating revenues.

Tax Accounting

Plans for an interesting session are under way under the direction of Chairman R. M. Campbell of the AGA Taxation Committee.

Materials and Supplies

The plans are proceeding under the direction of Chairman G. McDougall of the EEI and W. F. R. Münnich of the AGA and include the presentation of a short motion picture on the subject of Accounting for Materials and Supplies with Mechanical Accounting Equipment, and discussions of such matters as the accounting for "exempt" materials, inventory control and simplification of inventory procedures, maintaining Purchasing Department price records, and a review of machine accounting methods as applied to Stores records.

The Detroit Edison Company and the Michigan Consolidated Gas Company will be hosts to the Conference. These companies will welcome visits to their offices. Information clerks will be provided at the registration desks to facilitate the reviewing of points of interest in Detroit. Those desiring to visit the Ford River Rouge Plant and the famous Greenfield Village will have the opportunity on Wednesday afternoon.

CONVENTIONS AND MEETINGS

OCTOBER

4	General Sales Committee, EEI, The Homestead, Hot Springs, Va.
4-5	Public Utilities Association of West Virginia, The Greenbrier, White Sulphur Springs, W. Va.
7-8	Prime Movers Committee, EEI, William Penn Hotel, Pittsburgh, Pa.
7-8	Electrical Equipment Committee, EEI, Jefferson Hotel, Richmond, Va.
7-10	American Gas Association, Atlantic City, N. J.
7-11	National Safety Congress, The Stevens Hotel, Chicago, Ill.
10	4th Annual Commercial Electric Cooking Council Conference, Knickerbocker Hotel, Chicago, Ill.
14-15	American Society of Heating and Ventilating Engineers, Houston, Texas.
14-16	Transmission and Distribution Committee, EEI, Henry Grady Hotel, Atlanta, Ga.
14-17	International Municipal Signal Association, Roosevelt Hotel, Jacksonville, Fla.
21-23	National Electrical Contractors Association, George Washington Hotel, Jacksonville, Fla.
24-25	Accident Prevention Committee, EEI Headquarters, 420 Lexington Ave., New York, N. Y.
27-Nov. 1	National Electrical Manufacturers Association, Waldorf-Astoria Hotel, New York, N. Y.

NOVEMBER

11-12	Wisconsin Utilities Association, Electrical Section, Commercial and Technical Divisions, Pfister Hotel, Milwaukee, Wis.
14-15	Illinois Public Utilities Association, Pere Marquette Hotel, Peoria, Ill.
14-16	Annual Commercial Conference, Southeastern Electric Exchange, Atlanta, Ga.

DECEMBER

2-3	Prime Movers Committee, EEI Headquarters, New York, N. Y.
2-4	Fourth National Accounting Conference, AGA-EEI, Book-Cadillac Hotel, Detroit, Mich.
2-5	American Society of Mechanical Engineers, New York, N. Y.
9-11	National Warm Air Heating and Air Conditioning Association, Detroit, Mich.
10-12	National Association of Railroad and Utilities Commissioners, Miami, Fla.

JANUARY

15-18	American Society of Civil Engineers, Baltimore, Md.
27-29	American Society of Heating and Ventilating Engineers, Kansas City, Mo.
27-31	American Institute of Electrical Engineers, Philadelphia, Pa.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF MARCH 3, 1933

Of EDISON ELECTRIC INSTITUTE BULLETIN, published monthly at Philadelphia, Pa., for October 1, 1940.

State of New York.
County of New York.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Wilgar Coleman, who, having been duly sworn according to law, deposes and says that he is the Editor of the EDISON ELECTRIC INSTITUTE BULLETIN, and that the following is to the best of his knowledge and belief, a true statement of the ownership, management . . . etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in Section 537 Postal Laws and Regulations . . . to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, EDISON ELECTRIC INSTITUTE, 420 Lexington Avenue, New York City; Editor, Wilgar Coleman, 420 Lexington Avenue, New York City; Managing Editor, none; Business Manager, none.

2. That the owners are EDISON ELECTRIC INSTITUTE, 420 Lexington Avenue, New York City, a mutual organization, not incorporated: Charles W. Kellogg, President, New York, N. Y.; F. H. Nickerson, Treasurer, New York, N. Y.; H. S. Bennion, Vice President and Managing Director, New York, N. Y.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.

WILGAR COLEMAN,
Editor.

Sworn to and subscribed before me this 1st day of October, 1940.

(Seal) MAE B. WOODS.
Notary Public, Queens County.
(My commission expires March 30, 1941)

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1940-1941

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